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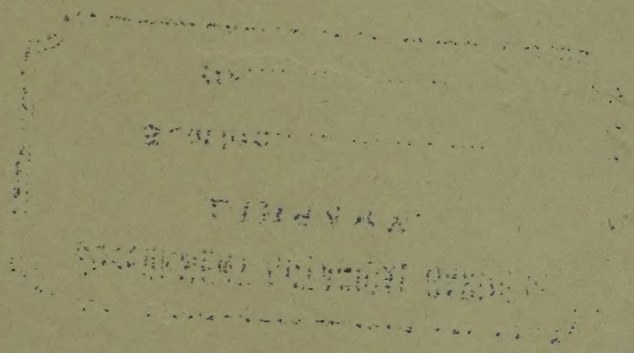

GOVERNMENT BOTANICAL GARDENS
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MISSOURI

BOTANICAL GARDEN.

NINTH ANNUAL REPORT.

ST. LOUIS, MO.:
PUBLISHED BY THE BOARD OF TRUSTEES.
1898.

BOARD OF TRUSTEES OF THE MISSOURI BOTANICAL GARDEN.

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Mayor of the City of St. Louis.*

A. D. CUNNINGHAM, Secretary.

---

* *Ex-officio.*

1 Elected President of the Academy of Science of St. Louis, January 3, 1898, to succeed Melvin L. Gray, who had met with the Board since January, 1896.

GOVERNMENT BOTANICAL GARDENS
LIBRARY.
Section.....
No.....

PREFACE.

Under the direction of the Board of Trustees, the ninth annual report of the Missouri Botanical Garden is presented to the public. The eighth report was issued September 9, 1897. Advance copies of Mr. Thompson's paper on Lemnaceae were issued November 1, 1897, and advance copies of Dr. Glatfelter's paper on Salix were issued December 24, 1897.

The reports of the Garden are sent to scientific institutions and journals, in exchange for publications or specimens desirable for the library, herbarium, or plant-houses of the Garden. So far as possible, reprints of the botanical articles which they contain are sent to botanists occupied with a study of the same subjects.

Any of the Garden publications not out of print may be purchased, at approximately the cost of publication, from Dr. A. E. Foote, of Philadelphia, The Cambridge Botanical Supply Co., of Cambridge, Mass., W. Wesley & Son, of London, R. Friedländer & Sohn, of Berlin, or the undersigned. A list of publications to the end of 1896 was printed at page 221 of the eighth report.

WM. TRELEASE.

St. Louis, Mar. 9, 1898.

CONTENTS.

PAGE.

1. REPORTS FOR THE YEAR 1897:—
   - *a.* Report of the Officers of the Board 7
   - *b.* Ninth Annual Report of the Director 12

2. SCIENTIFIC PAPERS:—
   - *a.* A Revision of the American Lemnaceae occurring North of Mexico —
     By Charles Henry Thompson 21
   - *b.* Notes on Salix longipes, Shuttlw. and its Relations to S. nigra, Marsh —
     By N. M. Glatfelter, M. D. 43
   - *c.* A Revision of the Genus Capsicum with especial Reference to Garden Varieties —
     By H. C. Irish 53
   - *d.* List of Cryptogams collected in the Bahamas, Jamaica and Grand Cayman —
     By Albert S. Hitchcock 111
   - *e.* Agave Washingtonensis and other Agaves flowering in the Washington Botanical Garden in 1897 —
     By J. N. Rose 121
   - *f.* The Species of Cacti commonly cultivated under the Generic Name Anhalonium —
     By Charles Henry Thompson 127
   - *g.* Notes and Observations —
     1. The Epidendrum venosum of Florida —
        By William Trelease 137
     2. Miscellaneous Observations on Yucca —
        By William Trelease 141
     3. The Missouri Dogbanes —
        By William Trelease 147
     4. A Coloring Matter found in some Borraginaceae —
        By J. B. S. Norton 149
     5. Notes on some Plants, chiefly from the Southern United States —
        By J. B. S. Norton 151
     6. A new Disease of cultivated Palms —
        By William Trelease 159
     7. Parmelia molliuscula —
        By Henry Willey 160

LIST OF ILLUSTRATIONS.

Frontispiece, Ferns and Cycads.

The Main Gate . . . . . Facing page 7

Philodendron cannaefolium . . . . . " " 12

The New Range of Plant-Houses . . . . . " " 14

A Fruiting Mango . . . . . " " 18

Plates 1-4, North American Lemnaceae . . . . Following " 42

" 5-7, Species of Salix . . . . . " " 51

" 8-28, Varieties of Capsicum . . . . . " " 110

" 29-31, Species of Agave . . . . . " " 126

" 32-37, Species of Ariocarpus and Lophophora " " 136

" 38-39, Species of Epidendrum . . . . . " " 140

" 40-43, Species of Yucca . . . . . " " 146

" 44-45, Species of Apocynum . . . . . " " 148

" 46-50, Miscellaneous Species . . . . . " " 158

THE MAIN GATE.

[illegible]

REPORTS FOR THE YEAR 1897.

REPORT OF THE OFFICERS OF THE BOARD.

SUBMITTED TO THE TRUSTEES JANUARY 12, 1898.

To the Board of Trustees of the Missouri Botanical Garden:

We herewith present the financial results for the year ending December 31st, 1897. Our income from rentals shows an increase of $826.13 over those of 1896, notwithstanding several vacancies have existed throughout the entire year caused by a change in conditions, but they are mostly small buildings, and the loss of income from them is more than overcome by increased rentals in other sections.

Extensive alterations and repairs have been made to several buildings which have been leased for a term of years, and all properties of the Board are now in fairly good condition.

The application for power to sell certain non-productive properties west of Grand avenue, mention of which was made in our last report, is still pending in the Supreme Court of the State of Missouri, having been argued in October last, and an early decision is looked for.

Last spring ordinances were introduced and passed authorizing the opening and widening of Flora avenue from Grand to Tower Grove avenue, a distance of 4,438 feet, to a width of one hundred and forty feet, to be improved with driveways on either side of a park place in the center. This street is to be fully improved with granitoid curb, gutters and sidewalk, and telford pavement, with

sewers, gas and water service, trees, shubbery, etc. The work is now under way, being done by private contract, and when completed in the spring this will be the finest residence street in the city, and practically the Grand avenue entrance to the Garden. These improvements will cost the Board about fifty thousand dollars for its share of the property running the full distance on the north side, which will be paid for out of the surplus accumulations of several years; and should the Board be empowered to sell, this property will be the first to be offered.

The opportunity was offered the Board last spring of purchasing a triangular piece of ground of about 2½ acres adjoining and southwest of the Garden property, admitting of an extension of the Garden along Magnolia avenue on the south to Alfred avenue on the west. The acquisition of this property was recommended by the Messrs. F. L. and J. C. Olmsted, the landscape architects who have charge of the proposed addition to the Garden, and it was secured at a cost of ten thousand dollars, a reasonable price considering its desirability.

Large and valuable additions have been made to the Library and Herbarium, both by purchase and donation, and the following sums have been credited to the stock account as a permanent investment, which now aggregates $1,547,497.24:—

Books, purchased and donated	$7,188 79
Herbarium " " "	2,980 10
Plant House	7,496 93
	$17,665 82

Mr. Shaw's bequests for banquets, sermon, premiums for flower show and Shaw School of Botany have all been carried out as provided for in his will, and after caring for the Garden in a liberal manner, keeping properties of the Board in good repair and fully insured, and the payment of taxes, all out of the revenue of the year, we are enabled to carry forward as a surplus for the year, $2,252.26.

RECEIPTS.

Rents	$95,417 67	
Interest and dividends	6,558 50	
Garden, pasturage, sales, etc	486 07	
Garden handbook sales	69 75	
Publication sales	2 38	$102,534 37
Stock Account, loan collected	1,750 00	
Streets, damages for opening and widening	56,253 00	
Buildings, damages for removal	850 00	
Certificates of deposits cashed	168,064 27	226,917 27
		$329,451 64
Cash balance January 1st, 1897		6 35
Total		$329,457 99

EXPENDITURES.

Garden Account,		
Labor pay-roll	$12,407 36	
Students' pay-roll	1,583 10	
Office assistance	587 69	
Fuel	383 21	
Water	208 00	
Repairs and supplies	1,981 42	
Stable and implements	562 13	
Plants and seeds	1,486 22	$19,199 13
Herbarium,		
Office assistance and Janitor	380 07	
Extra mounting	210 57	
Fuel	76 15	
Current expenditure and specimens	4,232 01	4,898 80
Library,		
Office assistance	875 17	
Fuel	76 15	
Current expenditure	5,814 72	6,766 04
Office,		
Salaries	4,268 84	
Telephone	95 00	
Fuel	76 24	
Current expenditure	359 07	4,799 15
Research,		
Salaries	1,171 94	
Current expenditure	11 40	1,183 34
Carried forward		$36,846 46

Brought forward		$36,846 46
Scholarship,		
Instruction	$399 77	
Care of Lodge	240 00	
Fuel	53 44	
Current expenditure	131 51	824 72
Garden Improvement,		
Plant house	7,496 93	
Plans for extension, granitoid walks, grading, etc	2,704 41	
Addition to Garden, purchased	10,000 00	20,201 34
Total for Garden		$57,872 52
Publication Account,		
Annual volume	$1,992 96	
Catalogue of library	1,424 08	3,417 04
Property Expenses,		
Taxes, State, School, City and Sprinkling	24,899 54	
Streets, pavements and sewers	31,907 54	
Insurance	5,235 18	
Repairs	9,181 07	
Commission	500 00	
New improvements	1,400 67	73,124 00
Office Account,		
Salaries	3,600 00	
Rent of Office	835 00	
Printing, postage and telephone	465 19	4,900 19
Bequests,		
Flower Show	498 00	
Flower Sermon	200 00	
Trustees' Banquet	990 05	
Gardeners' Banquet	456 30	
Washington University, School of Botany	1,012 05	3,156 40
Sundries,		
Legal expenses	569 50	
Grading property	9,706 90	
Real estate purchased	6,593 75	
Streets, benefits for opening and widening	40,216 95	57,087 10
		$199,557 25
Certificates of deposits invested in 1897		71,491 86
Cash on hand Dec. 31, 1897		58,408 88
Total		$329,457 99

The books of the Board have been closed, showing the operations for the year ending December 31st, 1897, and after charging to Real Estate Account the balance of Streets, Pavements and Sewers Account, $25,578.39, the income has been disposed of as follows:—

Rent Account	$95,417 67	
Interest	6,558 50	
Garden Handbook	69 75	$102,045 92

CONTRA.

Garden Expense	$37,185 11	
Office Expense	4,900 19	
Commission	500 00	
Repairs	9,181 07	
Insurance	5,235 18	
Taxes	24,899 54	
New Improvements	550 67	
Legal Expense	569 50	
Washington University	1,012 05	
Annual Flower Sermon	200 00	
Annual Trustees' Banquet	990 05	
Annual Gardeners' Banquet	456 30	
Annual Flower Show	498 00	
Publications	3,414 66	
Garden Improvements	10,201 34	
Surplus for the Year	2,252 26	
		$102,045 92

Surplus to Dec. 31st, 1896	$73,824 84
Surplus for 1897	2,252 26
Total Surplus	$76,077 10

Respectfully submitted,

R. J. LACKLAND, President.

Attest:

A. D. CUNNINGHAM, Secretary.

NINTH ANNUAL REPORT OF THE DIRECTOR.

SUBMITTED TO THE TRUSTEES JAN. 12, 1898.

To the Board of Trustees of the Missouri Botanical Garden:

The following report on the Missouri Botanical Garden and the Henry Shaw School of Botany is respectfully submitted, in compliance with the rules of the Board.

THE BOTANICAL GARDEN.

During the past year the decorative features of the Garden have been maintained in about the same manner as heretofore, and in certain classes, especially orchids, considerable additions have been made to the collection of cultivated species, which, with their named varieties, are now estimated to number about 5,000.

In the course of the year, 252 consignments of plants and seeds were received at the Garden, of which 187 consignments, aggregating 6,538 plants and packets of seeds, valued at $1,204.29, were given or sent in exchange for Garden material. The Secretary's books show that the sum of $1,486.22 has been expended for the purchase of plants and seeds. During the year, 391 packets of seeds and 501 plants, appraised at $220.00, were distributed to institutions or individuals standing in exchange relation with the Garden, and some 1,348 potted plants, removed from the ground on the approach of winter, were given to charities,—by far the larger number going to the kindergartens of the Public Schools of the city, through the interest of Miss Mary C. McCulloch, the efficient head of that department of the City Schools.

PHILODENDRON CANNAEFOLIUM.

No marked increase or decrease in the number of visitors to the Garden has been observed by the Gate-keeper. On the first Sunday afternoon in June, which was rainy, 6,032 visitors were counted, and on the first Sunday afternoon in September 14,171 persons were counted at the gates.*

As was predicted last year,† it has proved necessary to remove many trees injured by the tornado of May, 1896, which were nevertheless considered worthy of preservation if practicable, and in a single month 55 such trees, mostly of large size, were consigned to the wood-pile. The destruction of these exposed and pollarded trees was greatly increased by the unusually hot and dry summer of 1897.‡ Some of the factors contributing to this great destruction of trees, and their mode of operation, have been made the subject of investigation by Mr. Norton, of the Garden, and Mr. von Schrenk, of the School of Botany, who presented their conclusions in detail before the Academy of Science of St. Louis.§

For the reasons stated in my last report,‖ although some progress has been made in the elaboration of plans and the preparation for carrying them out, the Board has not yet felt warranted in beginning the extension of the grounds on the general lines then indicated;¶ but a needed increase

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* For comparison, the number of visitors noted for the corresponding Sundays of previous years is appended:— In 1890, 20,000 and 3,000 (Rept. **2**: 15, 16). In 1892, 16,000 and 4,650 (Rept. **4**: 11). In 1893, 14,250 and 14,400 (Rept. **5**: 11). In 1894, 20,159 and 15,500 (Rept. **6**: 11). In 1895, 12,921 and 30,151 (Rept. **7**: 12). In 1896, 10,598 and 13,589 (Rept. **8**: 17).

† Rept. **8**: 18.

‡ The summary of the United States Weather Bureau of St. Louis for December shows that though, notwithstanding the dry summer, the aggregate precipitation for the entire year is 1.34 in. more than the annual average for the past twenty-seven years, the average daily temperature for the entire year is 2° F. in excess of the average for twenty-seven years.

§ Trans. Acad. Sci. of St. Louis **7**: lxxiii–lxxiv, lxxvi; **8**: 25–41. *pl. 3–9.*

‖ Rept. **8**: 36. ¶ Rept. **8**: 37, 40, 46.

in the plant houses was made, inclosing the work yard to the southeast of the small plant house built in 1894, in accordance with the plans submitted last year.* As a part of the new house is treated naturally, without the customary staging of florists' establishments, it is expected that effective planting out may be secured; and the addition of something over twenty feet to the stove house of 1894 will make possible a considerable increase in the number of orchids and foliage plants requiring a high temperature for their successful cultivation.

Owing to the concurrence of several unusually favorable circumstances, it has been possible to add very materially to the contents of the herbarium during the year. In addition to purchased current collections, which have this year been rather larger and more numerous than usual, the Garden has secured by purchase the large herbarium of the late J. H. Redfield, very rich in the earlier collections representing the flora of the United States; the herbarium of the late Dr. J. F. Joor, containing some 4,133 specimens, and largely adding to our representation of the flora of Louisiana and Texas; the large herbarium of Gustav Jermy, of San Antonio, Texas, which, in addition to a very full set of Carpathian plants, contains a nearly complete collection of the plants of Gillespie County, Texas, and a large number of other plants from the same State; an important prelinnean herbarium formed by Boehmer and Ludwig, and illustrating in part the Flora Lipsiae (1750) of the former; and 2,163 specimens collected in China by Dr. A. Henry.

Some of these sets have not yet been incorporated in the herbarium, but in the year past 23,772 specimens purchased, 231 collected by Garden employees, and 5,748 specimens received as gifts or in exchange, have been inserted in the cases; and 514 unmounted specimens,— mostly sets of Azorean duplicates,— were distributed to

* Rept. 8: 37, 41.

THE NEW RANGE OF PLANT HOUSES.

correspondents of the Garden. The present composition of the herbarium is as follows:—

The Engelmann herbarium (all groups), about		97,800	specimens.
The general herbarium:—			
Higher plants.			
The Bernhardi herbarium	61,120		
The Redfield herbarium*	4,511		
Other specimens	103,532		
		169,163	"
Thallophytes.			
The Bernhardi herbarium	126		
Other specimens	21,291		
		21,417	"
Making a total of about		288,380	
Valued at			$28,838 00

The following material, practically a part of the herbarium facilities, is essentially the same as reported a year ago:—

Wood specimens of various sizes	1,027,	valued at	$100 00
Wood veneers, by Spurr, Hough, Nördlinger, and Michel	2,254,	" "	155 00
Microscope slides, by Hough, Penhallow, Munroe, and others	1,051,	" "	250 00
Together	4,332,	" "	$505 00

Favorable circumstances have made it possible to add to the library even more largely than to the herbarium during 1897. In addition to a considerable number of sets of journals, proceedings of societies, etc., and many current works, procured from various sources, through the courtesy of a foreign dealer the Garden was able to secure practically all of its desiderata from the libraries of the late French botanists, Baillon and Duchartre. The additions by purchase amount to 2,243 books and 3,456 pamphlets, the expenditure for purchases and binding amounting to $5,744.32; and 301 books and 1,756 pamphlets, appraised

* So far as incorporated.

at $1,279.79 were given to the library by various correspondents,—in large part in exchange for the Garden publications.

The index has been increased by the addition of 16,468 cards, of which 7,040 were purchased and the remainder written by Garden employees. A large number of these cards refer to published mention of plants occurring in the State of Missouri; but this work of indexing the State flora is yet far from complete.

As now constituted, the library consists of:—

Pamphlets	18,060		
Books (general)	12,429		
		valued at	$43,368 31
Books (Sturtevant Prelinnean Library)	463	" "	2,315 00
MS. volumes (Engelmann)	60	" "	600 00
" " (Roetter)	1	" "	100 00
Total	31,013	" "	$46,383 31
Index cards	182,437	" "	1,824 37
Total valuation			$48,207 68

In the early part of the year, by direction of the Board, steps were taken toward publishing a catalogue of the library, and for this purpose the books and pamphlets have been re-catalogued directly from the shelves. It is hoped that the catalogue, which is estimated to contain not far from 35,000 entries, may be printed in the course of 1898.

The large additions to both herbarium and library have necessitated the removal of a portion of each from the herbarium building to the old museum building, in which some 550 running feet of shelving is now occupied by books; and there is no doubt that one of the most pressing needs of the early future is the provision of additional and better planned quarters for the library and herbarium. The general plans for the development of the Garden, adopted in 1896, provide for the extension of the present herbarium

building into three sides of a quadrangle devoted to administrative offices, and research and museum collections; and so soon as the Board shall find itself in a position to contemplate beginning work on these plans, steps will no doubt be taken to secure a suitable architectural treatment of this building so that a sufficient portion may be erected at an early day to relieve the present overcrowding of the cases and working quarters.

The instruction of garden pupils, on which a full report was made at the end of 1896,* has been conducted this year on the same lines as heretofore. One pupil, Otto Bogula, completed the course in March last, and was at once given responsible employment in charge of the garden and plant houses of an Eastern college. The vacancy thus created was filled by the award of a scholarship, on the result of examination, to Arthur Gross, who had been a paying pupil during the preceding autumn and winter. In October of the present year, under the general authority conferred by the Board in 1894,† the first lady pupil was admitted to the gardening course, in the person of Miss Eda A. Sutermeister, a graduate of the Kansas City High School, who takes this work as preparatory to the more advanced study of landscape art.

The office staff has remained unchanged through the past year, and, as in previous years, a small proportion of the time of the Director and his botanical and horticultural assistants has been given to research work, the more complete results of which have already been published or will shortly appear in the Reports of the Garden or elsewhere. Through the entire year one or more investigators not regularly in the employ of the institution have occupied research tables at the Garden, one of them being a candidate for the Doctor's degree from Washington University; and a considerable number of advanced workers from a distance have visited the Garden for the purpose of utilizing

* Rept. 8: 25. † Rept. 8: 31.

its library, herbarium and living collections in the prosecution of research.

Four annual events provided for in the will of Henry Shaw have taken place in the course of the year: the preaching of a sermon "on the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom;" the eighth banquet to the Trustees of the Garden and their invited guests; the eighth banquet to the gardeners of the institution, and invited florists, nurserymen and market gardeners; and the award of premiums or prizes at a flower show held in St. Louis.

The flower sermon was preached in Christ Church Cathedral, St. Louis, on the morning of May 16, by Rev. Dr. David H. Greer, of New York City.

The Trustees' banquet was given at the Mercantile Club, St. Louis, on the evening of May 14, 1897. Rt. Rev. D. S. Tuttle presided. Covers were laid for 85 persons. The speakers were President James H. Canfield, of the Ohio State University, Professor R. Ramsay Wright, of Toronto, Professor C. E. Bessey, of the University of Nebraska, and Professor N. L. Britton, Director of the New York Botanical Garden.

The eighth gardeners' banquet was given at the Mercantile Club, on the evening of June 10, 1897, on the occasion of the twenty-second annual convention of the American Association of Nurserymen, many members of which were present as guests of honor. Covers were laid for 185 persons. The Director of the Garden presided, and after the dinner had been served speeches appropriate to the occasion were made by Hon. D. R. Francis, Hon. N. H. Albaugh, President-elect Irving Rouse, of the American Association of Nurserymen, Capt. Loyd G. Harris, President J. W. Kunz, of the St. Louis Florists' Club, Mr. James Gurney, Mr. Charles W. Murtfeldt, and Professor F. W. Card.

The flower premiums for 1897 were awarded by the officers of the St. Louis Florists' Club, at the chrysanthemum

A FRUITING MANGO.

show held in the Public School Building, St. Louis, Nov. 9 to 13. Awards were made for the same general classes of plants and flowers as in preceding years, though an effort was made this year to bring out a display of certain classes of decorative plants hardy or half hardy in the latitude of St. Louis. The Henry Shaw medal, established in 1893* for the introduction of a valuable plant, was awarded to Luther Armstrong for his ever-blooming tuberose. The comments of disinterested persons warrant the belief that the Shaw premiums add materially to the effectiveness of the annual floral exhibitions, and the interest shown in the groups of named ferns, begonias, etc. brought out by these premiums, gives reason to believe that they are serving the purpose of popular education for which they have been planned. Thus far, however, the Shaw Medal has failed to bring out competition in the classes of highly meritorious new plants for which it ought to be awarded.

THE SCHOOL OF BOTANY.

At the end of the college year 1896–7, Mr. O. L. Simmons severed his connection with the School of Botany, and his place was taken at the beginning of the year 1897–8 by Mr. Hermann von Schrenk, while Mr. W. H. Rush continues to act as instructor in phanerogamic botany. Such courses † as have been elected by undergraduate students have been given at the University, and, as in previous years,‡ Miss A. I. Mulford has taught special classes at the Garden and elsewhere, planning them largely to meet the needs of teachers in the Public Schools of the city.

One candidate for the Doctor's degree has spent the late months of the past winter and the early months of the present winter in resident work at the Garden.

Very respectfully,

WILLIAM TRELEASE,
Director.

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* Rept. 5: 18. † Rept. 6: 24; 8: 47. ‡ Rept. 8: 48.

SCIENTIFIC PAPERS.

A REVISION OF THE AMERICAN LEMNACEAE OCCURRING NORTH OF MEXICO.

BY CHARLES HENRY THOMPSON.

Hitherto no revision of the Lemnaceae for the North American continent has been published, though a number of botanists have made some special study of the order at various periods. In 1839, Schleiden* published a monograph of the then known species in which occurs reference to a few of the American forms. In 1867, Austin † published in Gray's Manual the species of the northeastern United States. The year following Hegelmaier's ‡ general monograph appeared, in which are recorded the descriptions of many species from America previously unknown. Contemporaneously with these latter gentlemen Dr. Engelmann of St. Louis, and Dr. Torrey of New York, made careful studies of the species occurring in their respective localities, as well as the abundant material sent them from other points, the results of which were published from time to time in the Bulletin of the Torrey Botanical Club. In 1878 Hegelmaier ¶ revised the order for Brazil, giving further knowledge of some species that occur also in North America. In 1895, he ‖ again published a review

* Schleiden, M. J. Prodromus monographiae Lemnacearum oder Conspectus generum atque specierum. Linnaea. **13**: 385–392. 1839.

† Austin, C. F. Lemnaceae.—Gray, A., Man. Bot. 478. 1867. [5th ed.]

‡ Hegelmaier, Friedr. Monogr. Lemnaceen. May 1868.

¶ Hegelmaier, Friedr. Lemnaceae.—Martius, Fl. Bras. 3^2: 1–24. Feb. 1878.

‖ Hegelmaier, Friedr. Systematische Uebersicht der Lemnaceen. Engler's bot. Jahrb. 21^3: 268–305. Jan. 1895.

Separates issued Nov. 1, 1897.

of his original monograph, installing therein many changes from his former classification and adding several new species and farther territorial distribution. Other isolated notes and descriptions of species of the order found in America have been published by various authors at different times.

It is the object of the present work to bring together the results of all these labors, together with my own researches of the past two years, into a revision that will give an accurate record of the Lemnaceae of North America, north of Mexico. This revision is based on a study of rich collections contained in the herbaria of the Missouri Botanical Garden, containing the Engelmann collection; of Columbia College, containing the Torrey and Austin collections; of Harvard; and of the California Academy of Science: and furthermore upon a study of abundant living material of nearly every species, contributed by many correspondents or collected by myself. I desire to acknowledge as one of my greatest helps, in preparing this work, the exhaustive notes and sketches made by Dr. George Engelmann in his extensive study of the order during his lifetime. I am especially indebted to Miss Bertha Henney of Santa Cruz, California, for living material collected at that place and in San Francisco, and for valuable field-notes which have greatly aided to clear up many doubtful points that have hitherto existed concerning the western forms. Lastly my sincere thanks are due to Dr. Wm. Trelease at whose suggestion the work was undertaken and to whom, for his kind aid in many ways, is largely due any merit it may possess.

In classification I have followed, in a general way, that of Hegelmaier's revision of his monograph, he being the recognized authority on the order, deviating from it only where a thorough study of a group or species seemed, to my mind, to demand a change. For instance, I have reversed the positions of *Wolffia* and *Wolffiella*, being con-

vinced that from a morphological standpoint *Wolffiella* is more closely related to *Lemna* than is *Wolffia*.

In synonymy I have aimed to cite all original descriptions of the American species, and in addition to include those published names which are found occurring in the collections examined. In these herbaria occur many manuscript names which are of interest only in designating various forms. These it seems wise to omit.

Lemnaceae is an order comprising four well defined genera and about twenty-eight species, distributed throughout the torrid and temperate zones. In our range the four genera are represented by about thirteen species and one variety. Of these perhaps but two species and the variety are peculiar to it alone and ten are found only in the western hemisphere. To some extent the classification must necessarily be incomplete and perhaps slightly erroneous, due largely to the fact that in almost every species there is a strong tendency to vary widely according to the environments, and further because the flowers and fruit are but partially known in some species and wholly unknown in others. Again a difficulty is met with in undertaking a classification when it is found that a single species may have at least three marked stages of growth differing from each other so widely as to give rise to different specific names for each. In several species I recognize two stages which I designate as the active stage, the period when vegetative reproduction goes on most vigorously, and the fruiting stage, or that period when the fruit is being produced, at which time the fronds are always smaller and more or less unsymmetrical. In other species three marked stages are recognized, the two above mentioned and a third which may be considered a resting stage. This, from its importance, deserves more than passing mention. Hegelmaier,* in his monograph, describes and figures what he terms "winter fronds" in *Spirodela polyrrhiza*. The name, no

* Hegelmaier, Friedr. Monogr. Lemnac. 81. May 1868.

doubt, is derived from the fact that in this stage the plants were found to sink to the bottom of ponds and there pass the winter, and the following spring to rise to the surface again and begin anew the cycle of life. Biscoe* also made a careful study of this stage with like conclusions. This my study of the species proves true, but not the whole truth. I find that in midsummer if a pond gradually disappears through evaporation these "winter fronds" are produced in abundance, and as the shore line recedes they are found for a considerable distance up the bank, still in an apparently healthy state. To my knowledge ponds have entirely dried away and remained so during the winter, yet when the spring rains again renewed them the *Spirodela* reappeared, the first fronds emerging from these "winter buds." Hence they are a protection as well against drought as lower temperature. Hegelmaier† also described a form of *Lemna gibba* in which the fronds are flat and three-nerved, much resembling *L. minor*. Guppy,‡ from a long series of observations and study, found that these "flat fronds" performed the same functions as the "winter fronds" of *S. polyrrhiza*, sinking to the bottom of ponds in the fall and rising to the surface again in the spring, then continuing active vegetative reproduction. In the middle of June, 1897, I discovered a pond in St. Louis abundantly covered with sterile *L. minor*. The first part of September I again visited it hoping to secure fruiting specimens. The water had almost entirely disappeared by evaporation and only a small number of normal plants remained. These were sterile, but I discovered that they were producing a modified frond similar to the "winter frond" of *S. polyrrhiza*. Further search revealed these modified fronds in abundance in the remaining water, in the oozy

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* Biscoe, T. D. The winter state of our Duckweeds. Am. Nat. 7: 257–268. *pl. 3*. May 1873.

† Hegelmaier, Friedr. Monogr. Lemnac. 146. May 1868.

‡ Guppy, H. B. Habits of *Lemna minor*, *L. gibba* and *L. polyrrhiza*. Journ. Linn. Soc., Bot. 30: 325. 6 Oct. 1894.

mud along its margin, and still farther away from the water where the mud was quite hard. In all instances they preserved a healthy appearance, and when placed later in a vessel of fresh water began active growth by sending out normal fronds. A diligent search through the dead plants left by the receding water failed to reveal a single fruit.

Thus we have three species which produce specialized fronds whose ultimate object is to reproduce the species, independent of the normal sexual method, after a more or less prolonged resting period, in much the same manner as the tubers of *Nelumbium* and many other aquatics. Hence the terms "resting fronds" and "resting stage" are here used in preference to "winter fronds."

These various forms and stages have wrought much confusion. We find that a stage of one species so closely resembles one of another species as to cause the very common error of a wrong determination of specimens in herbaria. It is this confused condition, as well as the lack of an American standard to follow, that has induced me to undertake a revision that it is hoped will meet the requirement of a clear understanding of the order.

ANALYTICAL KEY.

I. Fronds with roots and two reproductive pouches.
  A. Roots more than one, fascicled. SPIRODELA.
    Fronds rounded obovate, 5-15-nerved. *S. polyrrhiza.*
  B. Root solitary. LEMNA.
    a. Fronds long stipitate, mostly submerged, forming large masses. *L. trisulca.*
    b. Fronds short stipitate or sessile, floating on the surface.
      1. Symmetrical or nearly so.
        * Oblong-obovate; fruit more or less lenticular.
          + Upper surface uniformly green; margin of the fruit unappendaged. *L. minor.*
          + + Upper surface mottled with irregular brown streaks; margin of the fruit with rounded wing lobes. *L. gibba.*
        ** Oblong to elliptical, small, green on both surfaces; fruit elongated, erect. *L. minima.*

2. Unsymmetrical.
   * Obliquely obovate, papulose along the median line.
     + Convex to strongly gibbous beneath, obscurely 3–7-nerved; rootsheath unappendaged. *L. gibba.*
     + + Flat beneath, moderately thick, distinctly 3-nerved; rootsheath with lateral wing appendages. *L. perpusilla.*
   * * Long oblong, thin.
     + Strongly 3-nerved; rootsheath with lateral wing appendages. *L. perpusilla trinervis.*
     + + Obscurely 1-nerved; rootsheath unappendaged. *L. cyclostasa.*

II. Fronds rootless, with but one reproductive pouch.
   A. Fronds thin, ligulate. WOLFFIELLA.
      a. Saber form; stipe insertion at the lower right-hand angle of the two walls of the pouch.
         1. Fronds 14–21 times as long as broad, apex flagellate; stipe scar raised. *W. Floridana.*
         2. Fronds 3–5.5 times as long as broad, apex bluntly rounded; stipe scar sessile, rounded. *W. oblonga.*
      b. Tongue shaped, 1.5-3.5 times as long as broad, large; stipe insertion on the margin of the lower wall of the pouch. *W. lingulata.*
   B. Fronds thick, more or less globular. WOLFFIA.
      a. More or less flattened above, gibbous beneath, brown punctate.
         1. Rounded ovate, strongly gibbous, sparingly punctate beneath, dorsal surface with a prominent papule near the center. *W. papulifera.*
         2. More or less oblong, less gibbous, abundantly punctate on both surfaces, dorsal surface smooth. *W. punctata.*
      b. Globose to ellipsoidal, not punctate, dorsal surface with usually about three inconspicuous papules along the median line. *W. Columbiana.*

LEMNACEAE.

Each plant is a fleshy or membranaceous modified stem (frond) floating free, beneath or upon the surface of pools or slowly running streams. The inflorescence is a very simple form of spadix consisting of one pistillate and one or two staminate flowers inserted upon a common point. The pistillate flower consists of a single carpel containing from one to several ovules, and the staminate flower of a single stamen.

Spirodela Schleiden, Linnaea. **13**: 391. 1839.

Stipe attached (peltately) to the frond back of and under the basal margin. Reproductive pouches two, triangular, opening as clefts in either margin of the basal portion of the frond. Roots more than one, fascicled. Spadix of one pistillate and two staminate flowers from the vegetative reproduction pouches; spathe sac-like; filaments curving upward from the margin of the frond; anthers bilocellate, dehiscing longitudinally. Fruit rounded lenticular, with wing margins.

SPIRODELA POLYRRHIZA (L.) Schleiden, Linnaea. **13**: 392. 1839. *Lemna polyrhiza* Linn. Sp. Plant. 970. 1753. *Lemna thermalis* Beauv. Mémoire sur les Lemna. 13. 11 Sept. 1815. *Lemna umbonata* A. Br. ex Hglm. Monogr. Lemnac. 156. May 1868.

Fronds solitary or united in colonies of 2–5, roundish obovate, slightly unsymmetrical, flat on both sides, sessile or short stipitate, stipe deciduous; apex obtuse or acute; 5–15-nerved, 2.5–4.5 mm. wide by 2.5–8 mm. long (usually 3–6 mm. long). Roots 4–16; rootcap large, straight, .176–.235 mm. in diameter by 1.3–1.5 mm. long, sharp pointed. Usually sterile and wintering over by specialized resting fronds. Fertile fronds extremely rare. Spathe a complete sac, opening at the upper end. Anthers .33 mm. in transverse diameter; pollen grains spinulose, globose to ellipsoidal, .018–.023 mm. in diameter. Pistil flask shaped; ovules 2, anatropous, or frequently 1 and then amphitropous. Fruit somewhat winged along the margin; seed slightly compressed, smooth; spongy testa very thick; operculum distinct; endosperm dark brown, thin; albumen considerable; embryo cylindrical, nearly as long as the seed.— Abundant in ponds, rarely occurring in running water, thriving for a considerable time on very wet mud. A cosmopolitan species occurring abundantly throughout our range.— Plate 1 A.

But one other species * is known in the western hemisphere and that is peculiar to South America.

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* SPIRODELA PUNCTATA (Meyer) Thompson. *Lemna? punctata* Meyer, Prim. Fl. Esseq. 262. 1818. Fronds solitary or more commonly 2–4, rarely more, successive generations cohering in a regular chain; elliptical to slightly obovate-oblong, unsymmetrical, inclined to kidney form; 1–1.6 mm. wide by 2–3.1 mm. long — averaging about 1.34 mm. by 2.56 mm.; thick; obscurely 3-nerved; convex above, frequently with a slight protuberance just over the point of the root attachment, flat beneath; apex rounded or rarely obtuse; base rounded, prominently winged with a narrow membranaceous margin extending almost half the length of the frond. Stipe persistent or deciduous, jointed at the peltate attachment to the frond. Abundantly punctate over both surfaces with brown epidermal pigment cells. Upper surface with numerous stomata. Roots one, two or three, fascicled, long, fragile, brown colored when dry; rootcap long and narrow (.18 mm. in diameter by 2.5 mm. long), straight, sharp pointed. Spathe ovoid to globose, sac form with opening at the top through which project the reproductive organs. Spadix of two staminate and one pistillate flower. Stamens with long filaments; anthers dehiscing longitudinally (?); pollen grains papillose, .021–.023 mm. in diameter. Pistil long ovate, slightly compressed; ovule solitary, amphitropous. Fruit lenticular, short and broad, 1 mm. high by 1.2 mm. broad; the upper lateral margins projecting into rounded wing-like lobes; style short. (Strikingly like a one-seeded fruit of *Lemna gibba*).—Plate 1 B.

The plants which furnish the original description by Meyer (Meyer, G. F. W. Prim. Fl. Esseq. [Introd. page vii.] 1818) were collected about 1814 in the territory of the Hollandish colonies along the Essequibo river in what is now British Guiana, South America. Since that time, so far as I can learn, no other collection of the species has been published. Neither Schleiden (Prodromus Monographiae Lemnacearum. Linnaea. **13**: 392. 1839) nor Hegelmaier (Monograph Lemnaceen. 150. 1868) was able to learn more of the plant than the original description gave.

My description of the species is based on a collection of the plants, in the United States national herbarium, made by the United States South Pacific Exploring Expedition under the command of Capt. Wilkes, U. S. N. in 1838–42. The specimens were collected at Orange Harbor, on the Tierra del Fuego island, at the extreme south end of South America, some time between Feb. 18 and April 17, 1839, this being the period of the expedition's stop at Orange Harbor, according to the report of Jenkins.

Inasmuch as these two localities are so widely separated and since it has been impossible to secure either specimens or further publications of Meyer's original plants, some question may arise as to the identity of the two collections. Yet in view of the fact that many species of the order have even a far wider range, and since the Fuegian plants answer Meyer's

Specimens examined from Ontario (Fowler, 1883); Maine (Fernald, 1891); Vermont (Brown); Rhode Island (Thurber, 1846); Connecticut (Eaton; Eames, 1895); New York (Austin; Leggett, 1870, fertile); New Jersey (Parker, 1861); Pennsylvania (Thurber, 1848); Virginia (Vasey, 1874); South Carolina (Ravenel, 1872); Florida (Curtiss, no. 4544, 1894; Nash, no. 2282, 1895); Michigan (Bigelow, 1865; Gillman, 1871); Wisconsin (Hale, 1861); Illinois (Hall, 1867; Schneck, 1893, resting fronds); Tennessee (Gattinger, 1882); Minnesota (Hale, 1861); Iowa (Fink, no. 398, 1894); Missouri (Broadhead, 1864; Engelmann, 1867; Trelease, 1895; Widmann, 1895; Bush, no. 1583, 1892 and no. 797, 1896; Thompson, 1896); Arkansas (Engelmann, 1835); Louisiana (Dr. Hale, about 1830–40; Hilgard, 1867); Nebraska (Webber, 1889; Rydberg, no. 1258, 1893); Kansas (Kellerman and Carleton, 1884; Norton, 1893; K. S. A. C., no. 533, 1895); Texas (Mex. Bound. Surv., no. 1412, 1855–56; Reverchon, no. 492, 1877); Utah (Jones, no. 5979, 1894); Nevada (Watson, no. 1126, 1867); Oregon (Hall, no. 498, 1871); California (Brewer, no. 2190, 1860–62; S. B. and W. F. Parish, no. 1100, in part, 1881; Rattan, no. 59, 1884).

Lemna Linn. Sp. Plant. 970. 1753.

Stipe attached to the basal margin of the frond. Reproductive pouches two, triangular, opening as clefts in either margin of the basal portion of the frond. Root solitary. Spadix of one pistillate and two staminate flowers, produced in the vegetative reproduction pouches; spathe various; filaments curving upward from the margin of the frond. Anthers bilocellate, dehiscing transversely.

* Spathe sac-like; ovules amphitropous when solitary, anatropous when more than one; rootsheath long, cylindrical, unappendaged.

+ Fronds sessile or very short stipitate, more or less wing-margined on either side of the base, subpeltately attached; fruit rounded lenticular; rootcap bluntly rounded.

++ Fronds pale and usually strongly gibbous beneath, green and brown mottled above; fruit winged with rounded lobes at the upper margin on either side of the stigma; seeds one or more.

LEMNA GIBBA Linn. Sp. Plant. 970. 1753. *Telmatophace gibba* Schleid. Linnaea **13**: 391. 1839.

Fronds solitary to four in a group, commonly two, orbicular to obovate, 2–4 mm. wide by 2–5 mm. long, thick,

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description so admirably in all essential characters, I feel perfectly justified in identifying the one with the other.

convex and slightly keeled above and flat or slightly convex to hemisperically gibbous beneath, cavernous throughout, cavities very large in the gibbous portion; slightly to decidedly unsymmetrical, usually 3–5 nerved; base usually acute and commonly with narrow wing margins. Rootcap cylindrical, straight or slightly curved, about .25 mm. in diameter by 1.3–2.2 mm. long. Spathe irregularly torn by the developing flowers; pollen grains globose, spinulose; pistil clavate, compressed; stigma concave; style long or in the fruit short; ovules 1–7. Fruit symmetrical, purple tinted; seeds with thick covering, prominently and unevenly ribbed, with many transverse striations.— Abundant in ponds. A cosmopolitan species occurring only in the western and southwestern part of our range.— Plate 2 A.

This species is reported from the eastern States, but collections from east of the Mississippi river have failed to come under my observation. These are probably the ones Austin* refers to his varieties of *L. minor*.

Specimens examined from Nebraska (Rydberg, no. 1503, 1893); Texas (Wright; Mex. Bound. Surv., no. 1411, 1855-56); Wyoming (Forwood, 1882); New Mexico (Wright, no. 1892, 1852); Arizona (Coues and Palmer, no. 445, 1865; Toumey, 1894–95); California (Bigelow, 1853–54; Brewer, no. 30, 1860–62; Torrey, no. 504, 1865; Kellogg and Harford, no. 948, 1868–69; Bolander, 1870; Palmer, no. 372, 1875; Cooper, 1879; Henney, nos. 104, 106, 109, 112, 1896; Thompson, no. 207, 1896).

++ ++ Fronds green or purplish beneath, slightly convex, uniformly bright green above; fruit not winged; seed always solitary.

LEMNA MINOR Linn. Sp. Plant. 970. 1753.

Fronds solitary or few clustered, round to elliptic-obovate, 1.5–3 mm. wide by 2–4 mm. long; symmetrical, or in fruit slightly unsymmetrical; thickish; convex on both sides, upper surface sometimes slightly keeled and with a row of papules along the midnerve, the apical one usually quite prominent; obscurely 3-nerved; cavernous throughout. Rootcap comparatively short. Spathe with a small

* Austin, C. F. Lemnaceae, in A. Gray, Man. Bot. 479. 1867 [5th ed.]

cleft opening which is irregularly torn by the developing floral organs. Pistil clavate; ovule solitary. Fruit symmetrical, projecting about one-third beyond the margin of the frond; style short. Seed oblong-ovate; operculum prominent, directed forward, rounded; ribs 12–15, uneven, high; seed coat thick, with many transverse striations.— Prolific, soon covering the surface of stagnant ponds. One of the most widely distributed species, occurring throughout our range.— Plate 2 B.

The species is quite variable and in the vegetative stage very closely approaches the nongibbous resting stage of *L. gibba*. Striking examples of this are the Fink collections in Iowa (nos. 275, 399, 1894).

Specimens examined from Nova Scotia (Fowler, 1868); Ontario (Gillman, 1870); Vancouver Island (Macoun, 1887); Massachusetts (Trelease, 1881); Connecticut (Eames, 1894); New York (Wright; Clinton, 1867); New Jersey (Austin, 1862; Leggett, 1868); Pennsylvania (Austin); Florida (Chapman, 1868; Canby, no. 17, 1869; Curtiss, no. 2695, 1881); Michigan (Bigelow, 1867; Gillman, 1870); Wisconsin (Blount; Trelease 1887); Indiana (Simmons, 1895); Illinois (Hall, 1861; Eggert, 1887; Thompson, no. 253, 1897); Minnesota (Sheldon, 1892); Iowa (Fink, nos. 275, 399, 1894); Missouri (Engelmann, 1865; Bush, no. 523, 1896; Henney and Thompson, 1896); Louisiana (Robbins, 1860; Hilgard, 1867); South Dakota (Rydberg, no. 1066, 1892); Nebraska (Webber, 1889; Clements, no. 2800, 1893; Rydberg, no. 1257, 1893); Indian Territory (Palmer, no. 316a, 1868); Colorado (Brandegee, 1876; Jones, no. 603, 1878); New Mexico (Fendler, no. 1008, 1847; Bigelow, 1853); Idaho (Sandberg, no. 801, 1892); Utah (Jones, no. 1693, 1880, and no. 5321, 1894); Nevada (Bailey, no. 1125, 1867; Watson, 1867); Washington (Henderson, no. 2534, 1892); Oregon (Hall, nos. 496, 497, 1871); California (S. B. and W.F. Parish, no 914, 1881; Thompson, 1896).

+- +- Fronds with a long stipe attached directly to the basal margin; young fronds projecting at right angles to the parent, forming a cross; fruit broadly oblong lenticular; rootcap acute pointed.

LEMNA TRISULCA Linn. Sp. Plant. 970. 1753.

Fronds aerial and submerged, long persistent, usually many generations remaining attached and forming dense masses; oblong to oblong-lanceolate; slightly unsymmetri-

cal and frequently a little falcate; 2–3 mm. wide by 5–10 mm. long; without papules of any kind; converging terminal margins serrate and commonly fluted; apex acute; base hastate in the young fronds, in the older ones attenuated into a flat stipe about .5 mm. wide by 4–13 mm. long; proliferous from both pouches. Aerial fronds cavernous throughout the central portion, shorter stipitate and less persistent. Submerged fronds longer, more persistent, thinner and with long twisted stipes. Roots frequently absent; rootsheath soon disappearing. Seed prominently 12–15 ribbed with numerous transverse striations.—Prolific. This is a cosmopolitan species of very wide distribution, adapting itself to much colder temperature than any other species; not infrequently a hardy perennial. Common in springs and running water throughout our range.— Plate 2 C.

Specimens examined from Saskatchewan (Bourgeau, 1857–58); Ontario (Fowler, 1881); Vancouver Island (Macoun, 1887); Massachusetts (Boott, 1859 and 1867); New York (Clinton; Austin; Britton, 1892); New Jersey (Austin, 1866); Michigan (Bigelow, 1865; Gillman, 1871); Wisconsin (Hale; Lapham); Illinois (Engelmann, 1838; Hall, 1861); Minnesota (Ballard, 1893); Iowa (Hitchcock; Evermann, 1893); Missouri (Bush, no. 1495, 1886 and no. 536, 1896; Steadman, 1896); Arkansas, (Blankinship, 1888); Nebraska (Hayden, 1853; Webber, 1889; Williams, no. 7, 1890; Rydberg, no. 1397, 1893); Texas (Wright, no. 674; Schott, 1855–56; Mexican Boundary Survey, no. 1410, 1855–56); Wyoming (Rose, no. 401, 1893; Nelson, no. 2284, 1896; Adams on U. S. Geol. Survey, 1871; Knowlton, 1887,— the last two from Yellowstone National Park); Colorado (Brandegee, 1881); New Mexico (Wright, no. 1890, 1851–52; Fendler, no. 1007, 1874); Utah (Watson, no. 1123, 1869; Ward, no. 594, 1875; Jones, no. 6019, 1894); Nevada (Stretch, 1865; Watson, no. 1123, 1868); Arizona (Palmer, no. 531, 1890); Oregon (Howell, 1879); California (Redfield, no. 8062, 1872; Austin, 1878; Lemmon, 1879).

* * Spathe open; ovule solitary, obliquely orthotropous with the micropyle inclined toward the apex of the frond; stipe attached to the basal margin.

+– Frond 3-nerved; rootsheath with lateral longitudinal wing appendages; rootcap long, cylindrical, straight, sharp-pointed.

++ Fronds obliquely obovate to oblong-obovate, thick, nerves obscure.

LEMNA PERPUSILLA Torr. Fl. N. Y. 2: 245. 1843.
Lemna paucicostata Hglm. ex Engelm. in A. Gray, Man. Bot. 681. Jan. 1868. [5th ed. 8th iss.].—Hglm. Monogr. Lemnac. 139. May 1868.

Fronds solitary or more commonly long coherent, forming groups of 2-6 mature plants; sessile or very short stipitate; strongly unsymmetrical, or rarely nearly symmetrical in robust sterile individuals; 1.2–2.5 mm. wide by 2–3.5 mm. long; cavernous throughout. Apical dorsal papule usually prominent and frequently a row of smaller ones along the midnerve. Wings of the rootsheath varying from narrow to broad. Rootcap .85–2 mm. long. Fruit unsymmetrical, usually attached obliquely forward and outward, ovoid to oblong, ending in a rather prominent eccentric style; seed slightly compressed, ovoid to obliquely oblong, oblique in the utricle; seed coat thick, ribs prominent, varying from 12–16 in number, with numerous transverse striations.— Common in stagnant ponds throughout the eastern portion of our range and extending southward into South America. Rather variable.— Plate 3 A.

Dr. Torrey's original description indicates an anatropous ovule, but I have examined type material from his herbarium and find the ovule orthotropous, as described in Gray's manual.*

The original material of *Lemna paucicostata* Hglm. was collected about St. Louis and sent to Hegelmaier by Dr. Engelmann. These gentlemen studied the species together and in their correspondence referred to it as a variety of the Torrey species. In 1868 Engelmann published it as a distinct species, giving Hegelmaier the credit. This was four months previous to the appearance of Hegelmaier's monograph of the order, and with it his own description. I have collected quantities of material in the vicinity of St. Louis and identified it with the abundant type specimens of *paucicostata* in the Engelmann

* Gray, A. Man. Bot. 552. 1889. [6th ed.]

herbarium, and in neither of these do I find any constant difference from Torrey's species. In fact the descriptions of the two differ but slightly except in the number of ribs on the seed. This my study finds quite variable in the same pond though other characters are identical. Therefore I unhesitatingly place the American form heretofore credited to *paucicostata* under Torrey's *perpusilla*.

Specimens examined from Massachusetts (Clark); New York (Torrey, 1829); New Jersey (Austin, 1869); Pennsylvania (Austin, 1860; Small, 1891); Virginia (Coville, no. 35, 1890); South Carolina (comm. Torrey); Florida (Garber, 1869; Nash. no. 1591, 1894); Illinois (Engelmann, 1872; Schneck, no. 6, 1886; Eggert, 1896; Thompson, 1896; Hall); Missouri (Broadhead, 1864; Engelmann, 1867; Eggert, 1875; Bush. no. 584, 1896; Tracy, no. 19; Henney, 1896; Thompson, 1896); Arkansas (Eggert, 1896); Nebraska (Rydberg, no. 1723, 1893); Kansas (Norton. no. 532, 1895).

↔ ↔ Fronds more or less oblong, thin, strongly 3-nerved.

LEMNA PERPUSILLA Torr. var. TRINERVIS Austin, in Gray, Man. Bot. 479. 1867. [5th ed.]

Fronds solitary or cohering in twos or threes, rarely more; oblong to obovate-oblong; very slightly convex above, flat beneath; more elongated and less unsymmetrical than the species; apex more or less abruptly obtuse angled. Inflorescence and flowers as in the species. Fruit ovate, usually pointed by a rather long terminal style, nearly or quite symmetrical; seed ovate, erect or rarely slightly oblique. Otherwise partaking of the specific characters.— A characteristic variety of about the same territory as the type, growing with it or alone.— Plate 3 B.

Commonly mistaken for *L. cyclostasa* but readily distinguished, even the sterile fronds, by the three prominent nerves.

Specimens examined from New Jersey (Leggett, 1869); Illinois (Thompson, 1896); Tennessee (Gattinger, no. 2693, 1880); Missouri (Bush; Blankinship, 1889; Henney, 1896; Thompson, 1896); Louisiana (Dr. Hale, about 1830-40); Kansas (Hitchcock, no. 848, 1896); Indian Territory (Bush, no. 1334, 1895).

↔ ↔ Fronds obscurely 1-nerved or nerveless; rootsheath unappendaged.

↔ Fronds thin, without papules; rootcap strongly curved, tapering to a small rounded apex.

LEMNA CYCLOSTASA (Ell.) Chev. Fl. Par. **2**: 256. 1827. Schleid. Linnaea. **13**: 390. 1839. *Lemna minor* var.? *Cyclostasa* Elliott, Bot. S. Carol. and Ga. **2**: 518. 1824. *L. Valdiviana* Ph. Linnaea. **33**: 239. 1864. *L. Torreyi* Aust. in Gray, Man. Bot. 479. 1867. [5th ed.]. *L. abbreviata* Hglm. Engler's bot. Jahrb. **21**[3]: 298. Jan. 1895.

Fronds solitary or grouped, more commonly 2–8 cohering in a more or less curved chain; oblong to obovate-oblong; usually somewhat falcate, particularly in the smaller fruiting plants; .7–1.5 mm. wide by 2.3–4.5 mm. long; base usually strongly unsymmetrical, tapering into a short stipe or frequently sessile; cavernous in the middle portion only. Roots long; rootsheath large, thin, cylindrical; rootcap variable in length, usually long. Fruit slightly unsymmetrical, elongated ovate, pointed by the long straight or sometimes curved style; usually half the length of the frond; seed oblong-ovoid, with thick coat particularly at the apex, 12–29 ribbed, abundantly transversely striated.— An American species growing abundantly in our range from the Atlantic to the Pacific oceans, absent only in the northern part, extending southward into South America.— Plate 3 C.

The variableness of this species in the form of its fronds has given rise to many varietal and even specific names, but though frequently one individual may be remarkably different from another, yet I find no constant difference in any one particular that I would feel justified in recognizing a variety by, and furthermore I find all gradations of forms between the extremes. One such variation reported as a variety and later as a doubtful species is Hegelmaier's *Lemna* (*Valdiviana* var.) *abbreviata*, which I recognize only as a more symmetrical form of the species.

Specimens examined from Massachusetts (Kennedy, 1894; Deane, 1894); Rhode Island (Osterhout, 1893–94); Connecticut (Evans, 1889; Eames, 1895—both exceptionally large plants); New York (Torrey; Leggett, 1870; Young, 1873); New Jersey (Austin, 1862); South Carolina (Ravenel, 1850); Georgia (Ravenel, 1881; Schweinitz); Florida (Garber; Canby, no. 16, 1869; Ravenel, 1877; Nash, no. 894, 1894); Ohio (Hacker, 1895); Illinois (Engelmann, 1838); Missouri (Bush, 1895;

Trelease, 1895; Widmann, 1895); Arkansas (Engelmann, 1835; Eggert, 1892); Texas (Lindheimer, 1847–48); Wyoming (Rose, no. 401, in part, 1893); New Mexico (Wright, no. 1891, 1851); Utah (Jones, 1880 and no. 5983g, 1894); Nevada (Watson, no. 1124, 1868; Coville, 401, 1891); Arizona (Palmer, 1865; Coues and Palmer, no. 451, 1865); California (Bigelow, 1853–54; Bolander, no. 2662, 1866; Orcutt, 1883 — a very large form; Henney, nos. 107, 113b, 1896).

++++ Fronds thicker, with a row of papules along the midnerve; rootcap slightly curved, cylindrical, with bluntly rounded apex.

LEMNA MINIMA Philippi, Linnaea. **33**: 239. 1864. *Lemna platyclados* Hglm. Engler's bot. Jahrb. **21**[3]: 298. Jan. 1895.

Fronds solitary or cohering in groups of 2–4, commonly 2; symmetrical or with stipe scar but little to one side of the median line; oblong to elliptical; .9–2.7 mm. wide by 1.5–3.9 mm. long; apex rounded; lower surface flat or slightly convex, upper surface slightly to prominently convex, with thin margin entirely around the frond; cavernous in the middle portion only; commonly nerveless. Rootsheath thin, cylindrical. Rootcap usually short, rarely perfectly straight. Pistil short clavate, with concave stigma. Seed oblong, pointed, about 16-ribbed, with many transverse striations.— An American species occurring in the south and west parts of our range, from there south into South America.— Plate 3 D.

This species seems to have at least two fairly well-defined stages in its growth. The first may be termed the normal or more constant, for in it the fronds are uniformly very small (averaging 1.1 mm. wide, by 1.7 mm. long) and strikingly convex on the upper surface and of a straw yellowish or sometimes pale green color. The second is more variable in its habits and is characterized chiefly by larger sized, thinner green colored fronds, and more vigorous growth throughout. This answers perfectly Hegelmaier's description of *Lemna* (*Valdiviana* var.?) *platyclados*. The fronds readily change from one form to the other.

Specimens examined from Georgia (Ravenel, 1881); Florida (Curtiss, no. 4543, 1894); Kansas (Cragin, 1884); Wyoming (Forwood, 1882);

California (Bolander, 1867; Kellogg and Harford, nos. 946 and 947, 1868-69; Jones, no. 2356, 1881; S. B. and W. F. Parish, no. 1100 in part, 1881; Cleveland, 1884; Hansen, no. 482, 1893; Thompson, nos. 202, 205, 208, 1895–96; Henney, nos. 103, 105, 116, 1896).

Wolffiella Hegelmaier, Engler's bot. Jahrb. **21**[3]: 303. Jan. 1895.

Stipe attached on the margin of the single reproductive pouch. Pouch triangular, opening as a cleft in the basal margin of the frond. Fronds rootless, thin, unsymmetrical, curved in the form of the segment of a band, abundantly punctate on both surfaces with brown epidermal pigment cells. Flowers and fruit unknown.

* Saber form; stipe insertion at the lower angle of the two walls of the pouch.

WOLFFIELLA FLORIDANA (J. D. Smith).

Wolffia gladiata var. *Floridana* J. D. Smith, Bull. Torr. Bot. Club. **7**: 64. June 1880.—Thompson, Ligulate Wolffias of the United States. Rept. Mo. Bot. Gard. **7**: 101–111. *pl. 64–66*. 26 May 1896. *W. Floridana* J. D. Smith ex Hegelmaier, Engler's bot. Jahrb. **21**[3]: 305. Jan. 1895.

Fronds solitary or more commonly long coherent for several generations, in time forming densely interwoven masses; elongated strap-shaped, doubly curved to falcate and band form; tapering from the broad, rounded, oblique base to a long attenuated apex, frequently a little contracted just above the base; .4–.7 mm. in widest part, by 5.5–8.5 mm. long, about 14–21 times as long as broad; thin; cavernous throughout except a small portion of the apex; only a small area above the base exposed to the air. Basal portion of the attenuated stipe persistent, situated at the lower right hand angle of the reproductive pouch, connecting the two walls. Pouch elongated triangular or the upper angle rounded.—Occurring only in the southeastern part of our range.—Plate 4 A.

Closely related to *W. gladiata* Hglm., of Mexico, but differing in its constantly more narrow form, long flagellate apex, proportionately broader base, in being more cavernous, and having fewer and larger punctations.

Specimens examined from Georgia (Waite); Florida (Ravenel, 1877; Smith and Austin, 1878; J. D. Smith, 1878–80; Curtiss, no. 2699, 1881; Swingle, no. 71, 1892; Nash, no. 254, 1894); Missouri (Eggert; Bush, 1895; Widmann, 1895; Trelease, 1897); Arkansas (Eggert, 1892); Louisiana (Dr. Hale, about 1830–40); Texas (Joor, about 1877).

WOLFFIELLA OBLONGA (Ph.) Hglm. Engler's bot. Jahrb. **21**[3]: 303. Jan. 1895. *Lemna oblonga* Philippi, Linnaea. **29**: 45. 1857. *Wolffia oblonga* (Ph.) Hglm. Monogr. Lemnac. 131. 1868. *W. lingulata* Hglm. var. *minor* Hglm. Lemnac. in Martius Fl. Bras. **3**[2]: 10. Feb. 1878.

Fronds at maturity solitary or in pairs, rarely three cohering; long oblong or commonly gradually tapering from the obliquely rounded base to the slightly narrower bluntly rounded apex; slightly falcate, rarely nearly straight; basal portion alone exposed to the air; .53–1 mm. broad by 1.7–4.6 mm. long, about 3–5.5 times as long as broad. Reproductive pouch isosceles-triangular with the base a little narrower than the sides. Stipe scar small, blunt, rounded, situated at the lower right-hand juncture of the two walls of the pouch, conspicuous from the cluster of pigment cells it contains.— A Mexican and South American species, at present reported from but one locality in our range.— Plate 4 B.

Hegelmaier* was in doubt as to the advisability of separating this species from *W. lingulata* on the ground of the striking similarity of his *W. lingulata* var. *minor* to *W. oblonga*. My examination of a number of collections, both from Mexico and South America, prove beyond a doubt in my mind that his variety is not one of *W. lingulata* but merely an elongated form of *W. oblonga*. In the

* Hegelmaier, Friedr. Systematische Uebersicht der Lemnaceen. Engler's bot. Jahrb. **21**[3]: 303–304. Jan. 1895.

variety from Mexico city collected by Louis Hahn in 1868 and determined by Hegelmaier I find the stipe scar constantly as in *W. oblonga*, while in diminutive forms of *W. lingulata* I find the position of the stipe scar constantly the same as in the larger more normal form.

Specimens examined from California (S. B. and W. F. Parish, no. 1100, in part, 1881, San Bernardino Valley).

* * Tongue-shaped; stipe insertion on the margin of the lower wall of the pouch.

WOLFFIELLA LINGULATA Hglm. Engler's bot. Jahrb. **21**[3]: 303. Jan. 1895. *Wolffia lingulata* Hglm. Monogr. Lemnac. 132. May 1868. — Thompson, Ligulate Wolffias of the United States. Rept. Mo. Bot. Gard. **7**: 101–111. *pl. 64–66.* 26 May 1896.

Fronds at maturity solitary or rarely in twos; ovate to oblong tongue-shaped; slightly unsymmetrical; 1.7–3 mm. broad by 2.7–6.6 mm. long, about 1.5–3.5 times as long as broad; membranaceous; cavernous throughout the lower central portion; only a small part of the frond, above the base, exposed to the air; lateral margins upturned along the middle portion, immature fronds frequently flat. Reproductive pouch usually equilaterally triangular, sometimes an isosceles triangle with the base a little narrower or broader than the sides. Stipe scar evident, on the margin of the lower wall of the pouch, to the right of the median line, slightly raised, truncate.— A Mexican species which at present time is reported from but one locality in our range. These specimens were collected by my brother and myself in the irrigation canals of Kern County, California, in 1895–96, nos. 201, 204, 209.— Plate 4 C.

Wolffia Horkel ex Schleiden, Linnaea. **13**: 389. 1839.

Stipe attached under the solitary reproductive pouch and but a few cells from the margin. Fronds small, thick,

fleshy, more or less globular, and rootless. Reproductive pouch funnel form with its circular opening at the basal end of the frond. Spadix of one pistillate and one staminate flower, bursting through the tissues of the upper surface of the frond, without spathe; pistillate flower one carpeled and one ovuled; staminate flower of one stamen; anther unilocellate, dehiscing by a slit across the top, the two halves opening as reflex valves.

* More or less flattened above, gibbous beneath, brown punctate.

WOLFFIA PAPULIFERA n. sp.

Fronds slightly unsymmetrical, apparently symmetrical to the unaided eye; obliquely broadly ovate in horizontal outline; 1 mm. broad by 1–1.5 mm. long; apex rounded; upper surface flat at the margin, gradually ascending to form a single prominent large conical papule on the median line immediately below the center; under surface strongly gibbous, having the form of the half of a longitudinally divided egg; stomata numerous over the entire upper surface; abundantly punctate with brown epidermal pigment cells above, less so beneath. Cells of the upper portion small, of the lower large. Floating at the surface with the entire upper surface exposed to the air. Flowers and fruit unknown.— Thus far found only in Missouri, densely covering stagnant pools.— Plate 4 D.

This species is allied to the Brazilian type, but differs in its larger size, proportionately greater width, rounded apex, the presence of the large papule, and in the smaller number of pigment cells.

Collected by B. F. Bush, in Varner river, near Kennett, Mo., July, 1895, and again in quantity by myself (no. 250), at Columbia, Mo., June 5, 1897.

WOLFFIA PUNCTATA Grisebach, Fl. Brit. W. Ind. Isl. 512. 1864.

Fronds symmetrical; elliptical to ovate oblong; .35–.53 mm. broad by .58–.82 mm. long; upper surface flat or very

slightly convex, gradually rising at the acute apex like the bow of a boat; under surface gibbous; floating at the surface of pools with the entire upper surface of the frond exposed to the air; stomata numerous; profusely punctate throughout with brown epidermal pigment cells. Upper portion of the fronds consisting of small celled tissue, and the lower of large cells. "Utricle ellipsoidal" (Grisebach). Flowers and fruit unknown with us.—Occurring, in our range, east of the Mississippi river, from the Lake region to the Gulf of Mexico.—Plate 4 E.

This species as well as our North American plants have heretofore been referred to *W. Brasiliensis* Wedd. In comparing our form with Weddell's original material, as well as his description * of the species, I find a marked difference in the more elongated and less gibbous fronds, the upturned acutish apex and more numerous pigment cells.

Specimens examined from Ontario (Payne); Michigan (Bigelow, 1867); Illinois (Hall, 1867; Eggert, 1891); Tennessee (Gattinger).

* * Globose to ellipsoidal, not punctate.

WOLFFIA COLUMBIANA Karst. Bot. Unters. **1**: 103. 1865.

Fronds ellipsoidal to globose; symmetrical; upper surface convex with usually about three small inconspicuous papules in a row along the median line; .54–.8 mm. wide and deep by .48–1 mm. long; floating at the surface of the water with only a very small portion of the upper surface exposed to the air. In this area are to be found but a few (1–10) stomata. Pigment cells none. The body tissue is uniformly large celled throughout.—Occurring abundantly in ponds throughout the eastern half of Canada and the United States.—Plate 4 F.

Specimens examined from Ontario (Payne; Gillman, 1869); Massachusetts (Robbins, 1870); New York (Craig; Austin, 1866); New Jersey (Austin, 1867); Pennsylvania (Parker, 1868; Crawford, 1894; Kront, 1894); South Carolina (Ravenel, 1872); Florida (Curtiss); Michigan

* Weddell, H. A. Observations sur une espèce nouvelle du genre *Wolffia*. Ann. Sci. Natur. III. **12**: 170. 1849.

(Bigelow, 1867; Gillman, 1870; Campbell, 1886); Illinois (Hall, 1867; Eggert, 1891; Thompson, 1896); Kentucky (Barclay, 1895); Tennessee (Gattinger, 1882); Iowa (Hitchcock, 1888); Missouri (Engelmann, 1867; Bush, 1896; Thompson, no. 15, 1896); Louisiana (Riddell, 1867).

EXPLANATION OF PLATES ILLUSTRATING LEMNACEAE.

The figures are for the most part camera sketches of living material prepared at various times by the author. A few details are reproduced from Dr. Engelmann's sketches.

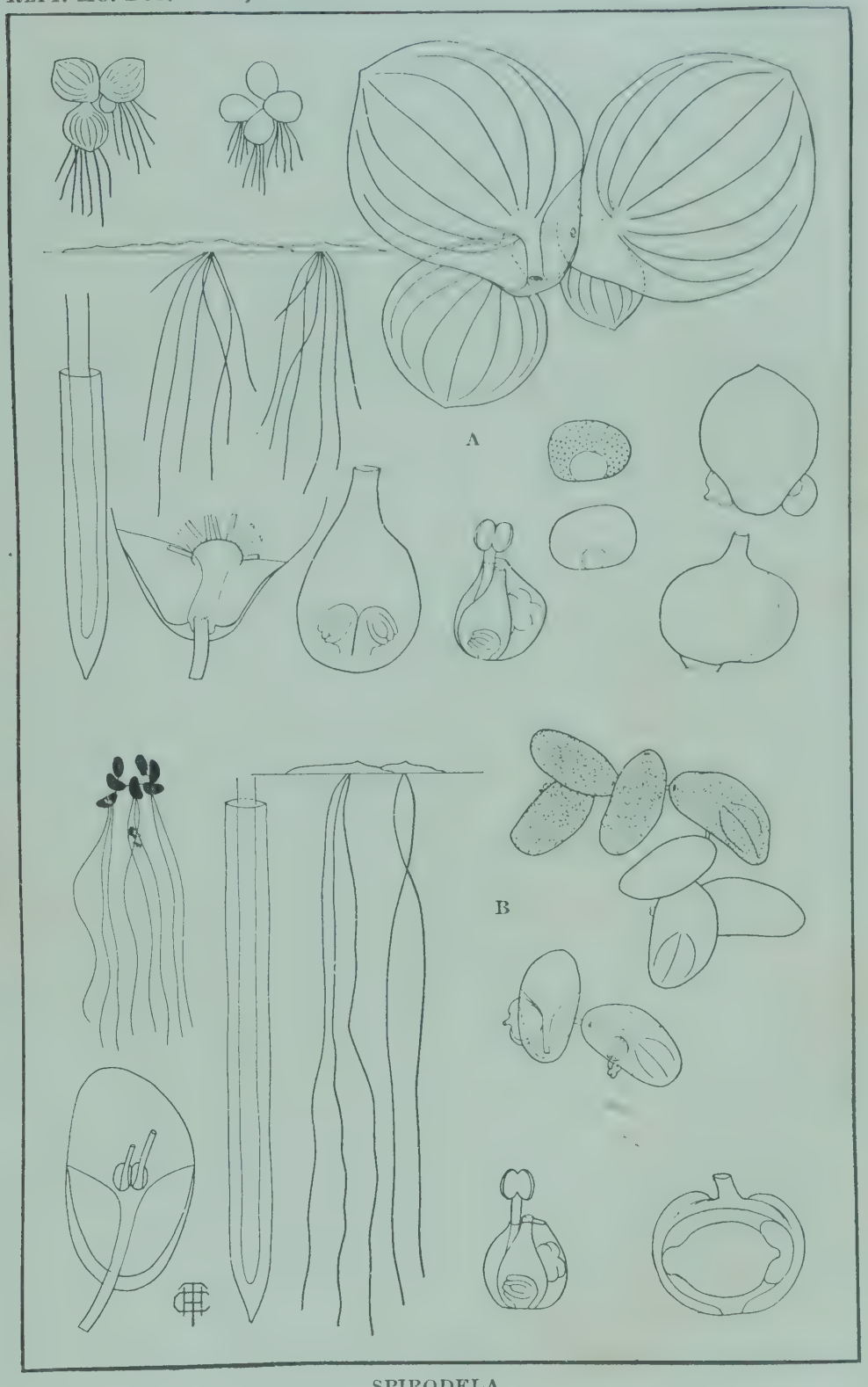
It has been the aim in each species to give only the distinguishing characters without going into the more minute structural details. In all species first is given a group of plants of natural size; a lateral view of the fronds on a water surface line, enlarged four diameters; a group of fronds enlarged five diameters, showing gross details; the basal portion of a frond enlarged five diameters, showing the attachment of the stipe, and in the first two genera showing the bases of the roots with their appendages. Also in each of these genera is shown a rootcap enlarged twenty-five diameters; an inflorescence enlarged fifteen diameters, showing spathe, pistil and two stamens. In a few instances a pistil is again represented enlarged thirty diameters. The fruit when represented is enlarged fifteen diameters and the seed ten diameters. In *Lemna minima* the seed is again enlarged to thirty diameters. In the genus *Wolffia* the fronds are again represented in lateral and basal views enlarged fifteen diameters.

Plate 1, A. *Spirodela polyrrhiza*, with details; B. *Spirodela punctata*, with details.

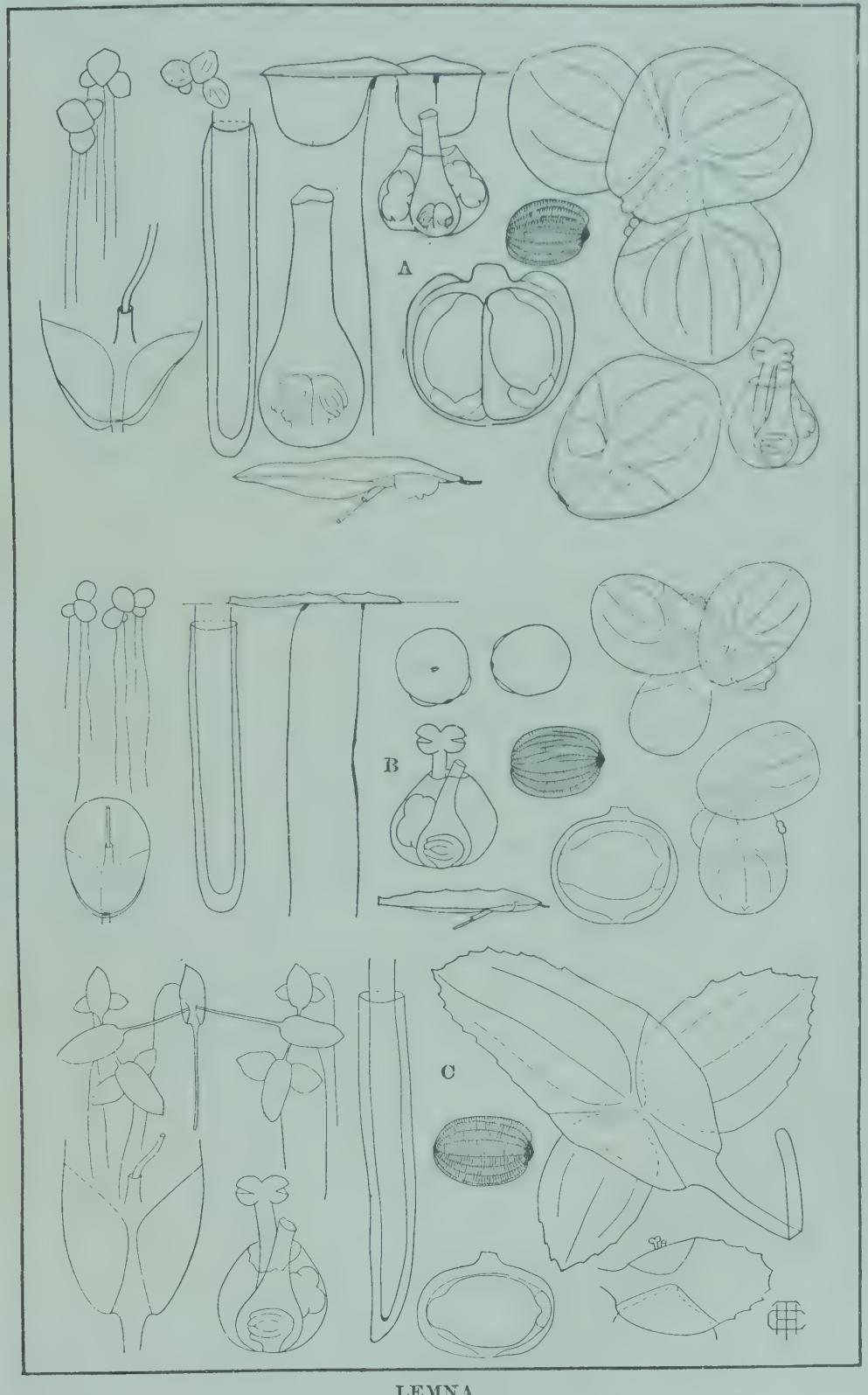
Plate 2, A. *Lemna gibba*, with details; B. *Lemna minor*, with details; C. *Lemna trisulca*, with details.

Plate 3, A. *Lemna perpusilla*, with details; B. *Lemna perpusilla* var. *trinervis*, with details; C. *Lemna cyclostasa*, with details; D. *Lemna minima*, with details.

Plate 4, A. *Wolffiella Floridana*, with details; B. *Wolffiella oblonga*, with details; C. *Wolffiella lingulata*, with details; D. *Wolffia papulifera*, with details; E. *Wolffia punctata*, with details; F. *Wolffia Columbiana*, with details; G. *Wolffia Brasiliensis*, with details.



SPIRODELA.



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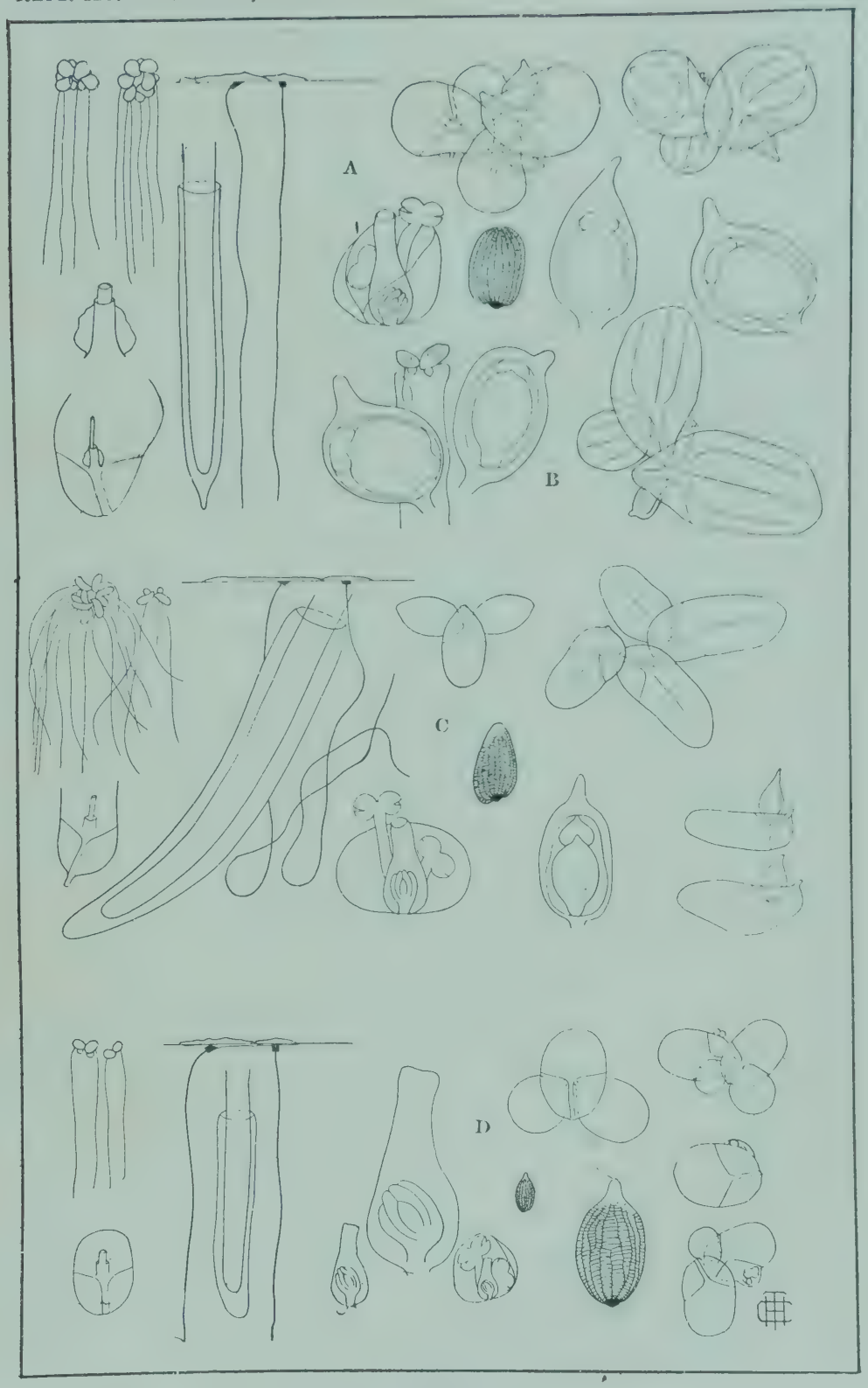

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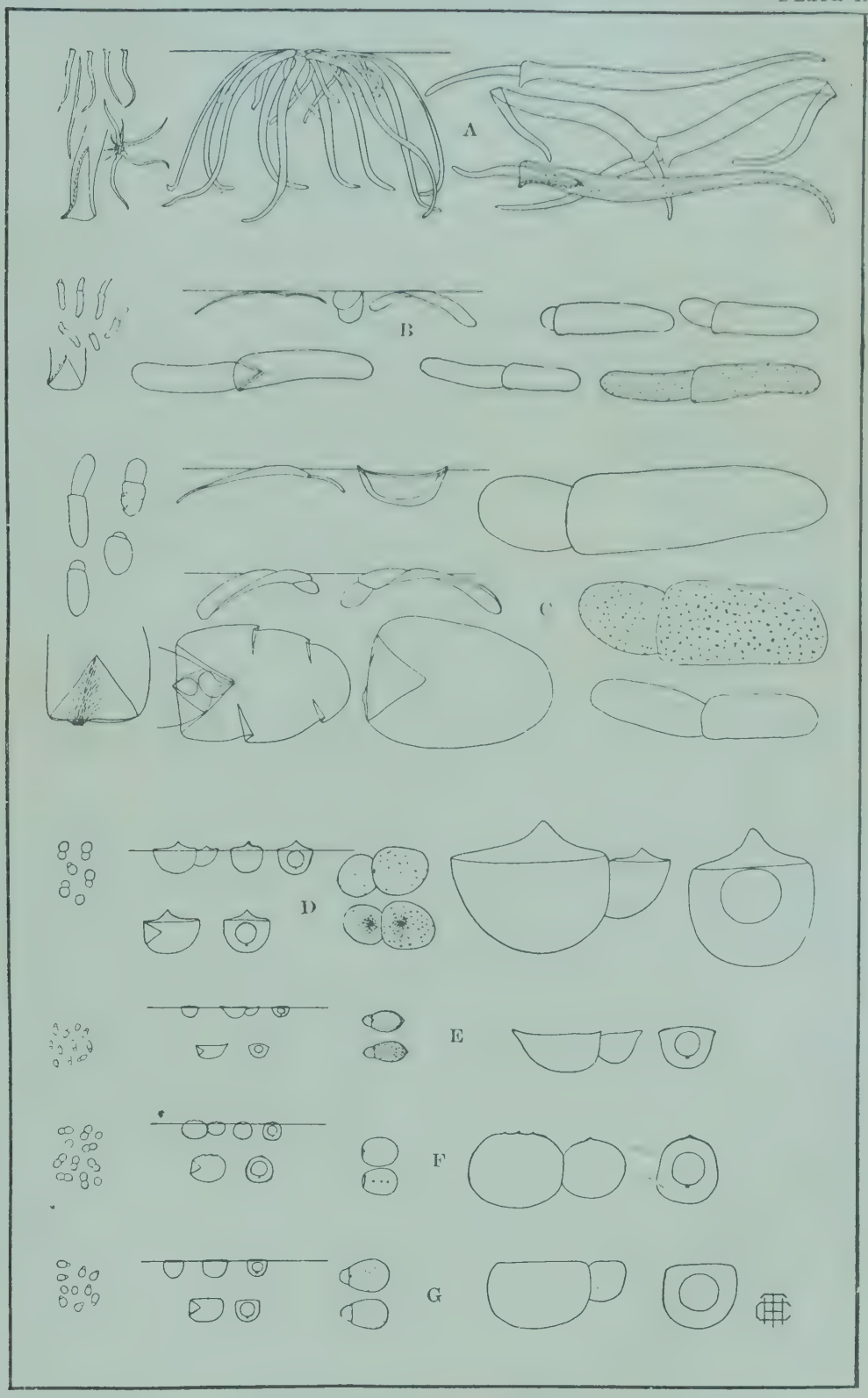


WOLFFIELLA AND WOLFFIA.

NOTES ON SALIX LONGIPES, SHUTTLW. AND ITS RELATIONS TO S. NIGRA, MARSH.

BY N. M. GLATFELTER, M. D.

This willow * was collected by C. W. Short at the falls of the Ohio river, Louisville, Ky., 1840; by Rugel at St. Marks, Florida, 1843, one of the original specimens being contained in the Missouri Botanical Garden Herbarium; by Dr. Engelmann at Belleville, Ill., 1849 (the specimen in the same herbarium unnamed); by L. F. Ward at Washington, D. C., 1880; by B. F. Bush in many counties of Southern Missouri (State Hort. Rept. 1895). In addition to the range as reported by Bush, the writer has observed it in St. François, Washington, Iron, Jefferson, and St. Louis counties, 1895, 1896, and also all the way along the St. Louis and San Francisco R. R. from St. Louis to Springfield, Greene Co., Mo. The northern limit in Missouri, according to present knowledge, is therefore a line drawn from the mouth of the Kansas river to the city of St. Louis. South of this it will probably be found in every county of the State, excepting several chiefly alluvial or swampy. In some parts of this region it appears to prevail, according to Mr. Bush, even to the exclusion of *S. nigra*. Mr. Henry Eggert also collected it in several of the southern counties, 1893; at Nashville, Tennessee, July, 1897; near Houston, Winston Co., Ala., Sept., 1897; and in western Tennessee. Mr. Bush collected it at Sapulpa and

* *Salix occidentalis*, var. *longipes*, Sargent, Silva. 9:109, 1896, and *S. Wardi*, Bebb, same authority. *S. Wardi*, Glatfelter, Science, n. series 2:582. 1895. *S. Wardi*, Bebb and *S. occidentalis*, var. *longipes*, Bebb, Garden and Forest, no. 394. 1895. *S. nigra*, var. *Wardi*, Flora of Washington, Bull. 22. 1881. *S. Floridanum*, Chapm. Fl. South. U. S. 1860. *S. longipes*, Shuttlw. in Anderss. Öfvers. af Vet. Akad. Förh. 114, 1858, and Monograph. Sal. 1868.

Separates issued Dec. 24, 1897.

Catale, Indian Territory, 1894; Dr. Chas. Mohr at Apalachicola Bay, 1892; Mr. Nash at Eustis, Lake Co., Florida, 1894; Mr. Ashe in Brunswick Co., N. Carolina, 1895; Mr. Heller in Kerr Co., Texas, 1894; Mr. Wright in N. Mexico, 1851. The writer has examined the available material from all the places mentioned, and he is under obligations to the U. S. National Museum, the Missouri Botanical Garden, and the Gray Herbarium of Harvard University, as well as Messrs. Bush, Eggert, Mohr, and Ashe.

An impartial investigation can no longer leave any doubt that Andersson's description of *S. longipes*, Shuttlw., in his monograph, covers all essential points inclusive of *S. Wardi*, Bebb, and that the latter name as distinctive of the species should be dropped. Inasmuch as the name *S. occidentalis*, Bosc, 1824, was applied to a species growing in the island of Cuba, and the material not at hand to show its relation to *S. longipes* of the United States, it seems best not to speculate on the matter. Mr. Bebb from the very first saw that the peculiar willow referred to him by Mr. Ward for identification, was allied to *S. longipes* (see Fl. Washington). His later separation of it into a distinct species can only be accounted for on the ground of insufficient material. As late as September, 1895, after the date of publication of the new species, he wrote me, "having only a beggarly account of unsatisfactory material of *S. longipes*," and, in the same letter, referring to my description of *S. Wardi*, writes "here is something which puzzles me 'the pubescent growing shoots hoary and heavy' of *S. Wardi* — this surely is a local departure for there is not a trace of anything of the kind on *Wardi*." This mistaken idea of Mr. Bebb's probably affords the clue. *S. longipes* was regarded as pubescent and by various degrees merging into the still more pubescent *S. occidentalis*. Now the fact is, the so-called *Wardi* has usually hoary pubescent shoots, and in many cases pubescent leaves, their pubescence however being lost before full maturity.

If the *Wardi* species were thus restricted only to the smooth form, most of the material that has come under my observation would be excluded. The writer has expressed elsewhere * his inappreciation of the value of pubescence as a character, in respect to another species of willow.

Endeavoring to arrive at the idea of the specific difference between *S. longipes* and *S. Wardi* from the descriptions hitherto given in so far as correctly represented, one is much more impressed by their almost perfect parallelism than by their divergence. The upshot has been that locality alone has been the determining factor in classing a given specimen either as *Wardi* or *longipes*, because of its collection at Washington or in Missouri on the one hand, or at more southern points on the other, as if the range were too large to be covered by one instead of two species.

S. longipes has, like many other willows, considerable variation even in the same locality, while some of the more widely separated localities enhance the variation still more. Andersson, in Monog. Sal., says that *S. occidentalis* intergrades through forms of *S. longipes* (f. *venulosa* and f. *gongylocarpa*) with *S. nigra* by innumerable intermediates. Letting *S. occidentalis* go as already stated, and confining our attention to the interval from *longipes* to *nigra*, how much of this intergrading should be assigned to variation *per se* and how much to hybridism, it is perhaps impossible to determine. Wherever I have had the opportunity to observe the growth of these willows in the field, the intergrading can readily be accounted for by the latter mode. Possibly the same would hold true of other localities.

The specimens from N. Carolina approach *S. nigra*. Mr. Bush's specimens from the Indian Territory, judged by the leaf alone, seem affected by the same, but the fruiting catkins surpass even the ordinary forms of *longipes* in length. Specimens from Texas plainly show the in-

* See Art. *S. cordata* × *sericea*. Bot. Gaz., p. 394, 1896.

fluence of *nigra*. One specimen identified by Heller as *nigra*, has the leaves of *nigra*, but the fruit of *longipes*. Another specimen identified by him as *longipes venulosa*, has fruit like a specimen from Watson, Mo., collected and named *S. nigra* by Mr. Bush. Specimens from N. Mexico show greater departure from the typical forms, and appear to approach nearer *S. nigra*. Of course in a case like this it is impossible to make any statement with assurance, on account of the limited accessible material. Specimens from Apalachicola Bay and elsewhere in Florida agree well with Washington and Missouri specimens. Those from Washington have shorter pedicels on an average than the others here mentioned, the latter presenting in general the widest divergence from *nigra* and being the purest examples of *S. longipes*.

While there appear no material differences between all the forms which have been united under *S. occidentalis* as exhibited in the United States and *S. Wardi*, Bebb, it can not be questioned that *S. nigra*, Marsh. is distinct. This distinction is presented to us by a number of prominent characters. First, *S. longipes*, Shuttlw. is a much smaller tree, the largest observed being rather under 30 ft. high and 9 in. in diameter at base, though usually much smaller. *S. nigra*, growing on the same spot, may attain double this size or more. Second, the bark of the trunk and larger branches is deeply cross-checked and firm, not flaky and shaggy as is *nigra* when old. This, once seen, serves to distinguish it from all other native willows even when bare of foliage. Third, the intense, whitish glaucous under surface of the leaves, together with the usually tomentose, young, very leafy shoots (though tomentum of the twigs is almost equally marked in some examples of *S. nigra*), enforces recognition even at a distance, or from a swiftly moving train. The impression thus made is assisted by a massiveness of foliage due to a vigorous growth of young shoots from the preceding year's branchlets, the ends of which are, at least in its more northern limits,

winter-killed. The resultant is a remarkably different expression in external outline from that caused by the more slender, somewhat drooping withes of *nigra*. Fourth, the twig can not be snapped off at its junction, being in marked contrast with the exceedingly brittle base of the *nigra* twig. The well-matured twig is gray with a brownish tinge, and often pubescent into the second year, while those less matured are reddish-brown and smooth. Fifth, the base of the leaf varies from the acute, through round, to the auricular form, the latter a feature not observed, to my knowledge, in any other willow. In *nigra*, the variation is at most only from the acute to the obtuse or roundish form. Sixth, the leaves are larger, the upper surface of a paler green; stipules larger, generally obtuse, seldom pointed, as they invariably are in *nigra;* aments mostly longer; fruit larger, discoloring a darker brown; pedicels longer; anthers a paler yellow. Seventh, *S. longipes* is exceedingly chary as to habitat, selecting almost invariably rocky, or at least gravelly portions of the stream, avoiding the alluvial stretches as if they were poisonous. This statement is confirmed by the independent observations of both Mr. Bush and Mr. Eggert, and also by Chapman. *Nigra*, on the other hand, occupies every situation or soil wherever it finds sufficient moisture. The former, though less hardy, appears to be a more vigorous grower. These appear to comprise all the important distinctions.

It was supposed, and so stated, that the time of flowering is about 10 days (2 to 3 weeks in Silva) later than of *nigra*, but this year's observation, in the vicinity of St. Louis, shows no material difference. A comparison is somewhat difficult, since this same season a variation of about 20 days in the blossoming of individual trees of *nigra* was noticed. Nevertheless, it has to be admitted that so much in this matter of flowering depends upon the varying character of the seasons, that nothing short of a series of observations would prove conclusive.

Again, in Mr. Bebb's original description he puts the

number of stamens as usually 3. While at the base of an ament there may be sometimes only 3, higher up I find the number varying from 4 to 7, in one instance 5 to 12!

Andersson says the stigmas are entire, and my previous observation was confirmatory in part. I now find, if examined when young, that the stigmas are, just as in *nigra*, almost always notched. The capsule of *Wardi* has been stated to be "minutely granular" (Fl. Washington), or "minutely glandular under a lens" (Garden and Forest). My examinations have failed to confirm these statements. In respect to the form of the capsule, the variation runs parallel with that of *nigra;* length of pedicel varies much, graduating into that of *nigra*.

The distinction into broad-leaved and narrow-leaved forms is too indefinite or unstable to be of importance, the variation in this respect being coincident with the similar variation of *nigra*. And lastly, the statement made in previous descriptions, of the prolonging of the flowering branchlet as a peculiarity of *Wardi*, is not distinctive. This character is generally present in the *nigra* of this region, but, owing to inferior vigor, is less developed.

Now, having passed in review the above mentioned striking differences, it seems most remarkable that there is almost precise agreement in their venation, a statement which would not be true, to my knowledge, respecting any other two species of willows. For the mode of venation should be regarded as usually one of the most constant and distinctive characters of the species of this genus. The foregoing observation has more especial reference to the extreme minuteness of the reticulation, a unique characteristic of the whole *nigra* group. The only difference noticed is the greater tendency of the primaries of *nigra* to form loops and the marginal line.*

I have found evident hybrids between *longipes* and *nigra* in all the localities visited. As might have been expected,

* See my paper on Venation of Salix. Rept. Mo. Bot. Gard. 5: 52.

the intergrading is complex, just as it is between *nigra* and *amygdaloides*, or between *sericea* and *cordata*, the characters of one or the other parent predominating, or constituting an almost equal compromise between the two. If the specimen in hand approaches *nigra*, the under surface of the leaf will have simply a pale cast, the capsule will be smaller, stipules pointed, ament and pedicel shorter, bases of the twigs brittle, the tree larger. Since *longipes* is peculiarly and intensely glaucous, while *nigra* is of a brilliant green, the gradual stages from one to the other may be, in a measure, gauged by the difference in degree of this character.

The late Mr. Bebb had some notions of a close relation existing between "*Wardi*" and *S. amygdaloides*, as if the former were the "geographical equivalent" of the latter. I regard *amygdaloides* a step farther removed from "*Wardi*" (*longipes*) than is *nigra*. These three willows have, however, one peculiar mark or bond of connection, so far as I know, limited to this group, in that they all have now and then what may be called palmate-veined leaves,— small oval or elliptical leaves more or less palmate-veined, which when present are found near the base of young shoots (Plate 6).

In the vicinity of St. Louis, we have growing together in the same locality *longipes*, *nigra*, and *amygdaloides*. We should expect hybrids therefore as follows: *nigra* × *amygdaloides; nigra* × *longipes; amygdaloides* × *longipes; nigra* × *amygdaloides* × *longipes*. Now, the *nigra* × *amygdaloides* hybrids are extremely common, amounting probably to 50 per cent.of the total black and *amygdaloides* willows. The combination *nigra* × *longipes* has already been commented upon in this paper. The combination *longipes* × *amygdaloides* is identifiable with great difficulty. The same of course is true of the combination *longipes* × *nigra* × *amygdaloides*. However, I have collected several specimens which, I can not doubt, are hybrids of either one or the other of these latter forms. The earlier flower-

ing of *amygdaloides* might seem a barrier to such a union, but when closely noted it is found the variation in this respect is greater than formerly suspected; besides, the union need not be directly with the pure form of *amygdaloides* but with its hybrid *amygdaloides* × *nigra*, flowering later.

Whether or not *S. longipes* should be divided into several forms or varieties is a question, owing to insufficient accumulation of material, not yet determinable. In view of what we know at the present day of the instability of some of our species of willows, it does not seem to fill the present demands of the scientific idea, to set up a number of forms from a limited number of herbarium specimens, and, besides, incomplete as we often find them. Without careful field observations, such work must inevitably prove defective. The plant must be seen in its habitat and in quantity before a just conception of all its characters can be formed. In this way, the supposedly good form will often vanish, to be supplanted by easily recognizable variations.

S. longipes and *S. nigra* afford a most remarkable and extremely interesting example of differentiation, retaining subtle resemblances which cause one sometimes to feel hesitation in regarding them as distinct. Thus, likeness of the veining, the general forms of the leaves, including serration, the pubescence, the gray or brown bark of the branchlets, the similar roundish lenticels, the resemblance of the scales, stipules, stamens, capsules and stigmas, continuation of the flowering stem, attacks of the leaf gall-mite, all these and other characteristics, with their shades of difference, besides, constantly remind the observer of their very near relationship. In view of this, perhaps the most astonishing fact is that though covering the same geographical range over the southern portion of our country, they should not have become fused into one, or inextricably confused, as is the case with *cordata* and *sericea* where found coincident. And yet, this very persistence of

ACC NO 5811

individuality, under such circumstances, is perhaps the strongest proof of their specific distinctness.

It is desirable that the range of *S. longipes* be better known. Our botanists of the South should, everywhere, look for it and report. With a view to further observations, the writer would request to have specimens sent him.

A few words in reference to the plates. The writer feels the inadequacy of such representations as can be given. A moment's look at an actual specimen is incomparably more instructive than the most painstaking attempt at reproduction. It is hardly possible to select a single leaf as typical even of a single plant, much less of a locality. In respect to the forms of leaves exhibited on the plates, let the reader therefore, not imagine that there are no other forms in the respective localities. The variations probably occur everywhere.

In conclusion, I desire to express my special obligations to Dr. Trelease for correcting copy and proof of this paper as well as for other kindly assistance.

EXPLANATION OF PLATES ILLUSTRATING SALIX.

The figures are from material selected by the author, and drawn, under his direction, by Miss Grace E. Johnson. Throughout, habit sketches, leaves, stipules and catkins are of natural size, capsules are × 2, and flowers are × 4.

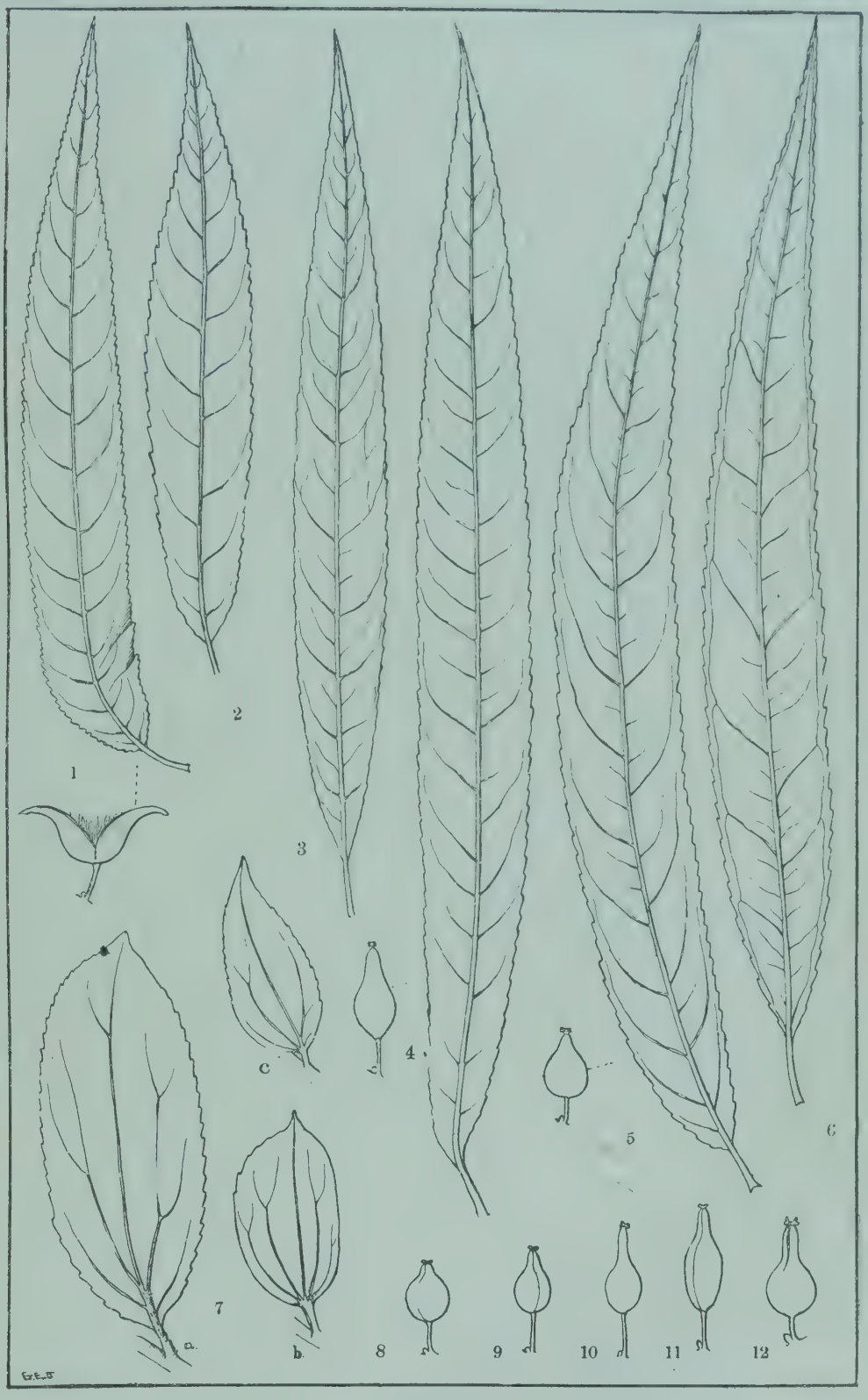
Salix nigra.—Plate 5, f. 2; plate 6, f. 6, f. 7c (both from St. Louis), f. 12 (Texas); plate 7, f 1a.

Salix longipes.—Plate 5, f. 1 (St. Marks, Florida, Rugel), f. 3 and 4 (Missouri); plate 6, f. 1 (Florida), f. 2 (North Carolina), f. 3 (Nashville, Tennessee), f. 4 (Texas), f. 5 (Missouri), f. 7a (palmate form of leaf), f. 8 (Carter County, Missouri), f. 9 (Bonne Terre, Missouri), f. 10 (Watson, Missouri); plate 7, f. 1, 2; 3 (Louisville, Kentucky), f. 4 (Washington, D. C.), f. 5 (St. Louis), f. 6 (Pilot Knob, Missouri), f. 7 (New Mexico).

Salix longipes, venulosa.—Plate 6, f. 11 (Texas).

Salix amygdaloides.—Plate 6, f. 7b (palmate form of leaf).

SALIX.



SALIX.

SALIX.

A REVISION OF THE GENUS CAPSICUM WITH ESPECIAL REFERENCE TO GARDEN VARIETIES.

BY H. C. IRISH.

A revision of the genus Capsicum * from an agricultural rather than a strictly botanical standpoint, was first suggested by Dr. E. Lewis Sturtevant,† who afterward himself selected the subject for special study and began collecting and cultivating a large number of kinds, at the same time recording complete descriptions from living plants. In 1892 all of his material bearing upon the subject, including many herbarium specimens, drawings, colored plates and notes was given to the Missouri Botanical Garden ‡ on condition that the genus should receive study with a view to the ultimate publication of the results in monographic form. All garden varieties which were procurable, together with numerous so-called species, have been cultivated at the Garden for four years, furnishing valuable material in the prosecution of the work. In beginning operations, Mr. F.

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* Tournef. Inst. 152. 1700.— Linn. Gen. Pl. 195. 1742.— Jussieu, Gen. Pl. 126. 1789.— Linn. Syst. Pl. **1**: 1050. 1797 [ed. Willd.].— Miller, Gard. Dict. 1797 [ed. Martyn].— Willd. Enum. Hort. Berol. 237. 1809.— Kunth, Nov. Gen. Sp. Pl. **3**: 48. 1818.—Fingerh. Monogr. Gen. Capsici. 1832.— Nees von Esenb. Trans. Linn. Soc. **17**: 62. 1832.— Meisner, Pl. Gen. 277. 1836–43.— Don, Hist. Dich. Pl. **4**: 444. 1838.— Endlicher, Gen. Pl. 665. 1840 [no. 3854].— Sendt. in Martius, Fl. Bras. **10**: 142. 1846.— Dunal in DC. Prodr. **13**[1]: 411. 1852.— Miquel, Fl. Ned. Ind. **2**: 657. 1856.— Benth. & Hooker, Gen. Pl. **2**: 892. 1876.— Nicholson, Dict. Gard. 1884.— Baillon, Hist. Pl. **9**: 331. 1888.— Engler & Prantl, Pflanzenfam. **4**[3b]: 20. 1891.— Kuntze, Revis. Gen. Pl. 447. 1891.

English, *Red Pepper, Guinea Pepper.*— French, *Piment, Poivre d'Inde ou de Guinea.*— German, *Spanischer Pfeffer.*— Italian, *Peperone.*— Mexican, *Chilli.*— Hindostan, *Tschili.*— Hungarian, *Paprika.*— Spanish, *Pimiento.*— Portuguese, *Pimento, Pimentas.*

† American Naturalist **25**: 550. 1885.

‡ Rept. Mo. Bot. Gard. **4**: 15. 1893.

W. Dewart, at that time Botanical Assistant at the Garden, made numerous observations, especially noting structural characters. Later Mr. J. G. Smith continued the work, following much the same plan. My own study of this genus began in the spring of 1896 with bringing together the material left by others, recording observations on the growing plants of that year, and comparing them with previous notes. In addition to the work of the gentlemen named, I am especially indebted to Professor William Trelease for valuable assistance and suggestions in all parts of the work.

Concerning the early history of Capsicum, there is abundant evidence that the entire genus had its origin in the American tropics, though numerous so-called species have been attributed to Southern Asia. It seems to have been first mentioned by Peter Martyn in an epistle dated September 1493, in which he says Columbus brought home "pepper more pungent than that from Caucasus." * De Candolle advances the opinion that a plant so easily grown and so agreeable to the tastes of inhabitants of warm countries would probably have been known previous to the discovery of America, whereas no ancient Sanskrit or Chinese name for the genus is known, neither were the Greeks, Romans, nor even Hebrews acquainted with it.† The rapidity with which the plants spread in tropical countries, together with the increased commercial trade immediately following the discovery of America, probably caused a rapid dissemination through the Old World tropics, where the plants were afterwards found by later botanists, many of whom supposed them to be indigenous.

The opinion of different authorities seems to vary greatly concerning the number of species and varieties. Three varieties were figured by Fuchsius in 1542, thirteen by Gregorius in 1611, twenty by Parkinson in 1640. Thirty-five were mentioned by Morison in 1699, twenty-seven by

* Sturtevant, American Naturalist 24: 151. 1890.

† De Candolle, Origin of Cultivated Plants 288. 1882.

Tournefort in 1700, eighteen by Miller in 1731, though in 1771, after the binomial system had come into use, he gave but ten specific names. Linnaeus in the first edition of his Species Plantarum (1753) records two species, and in his Mantissa (1767) recognizes two additional ones. In the fourteenth edition of his Systema Vegetabilium, edited by Murray (1789), one new species is given, and in the Willdenow edition of the Species Plantarum (1797) still another is added. Römer and Schultes, in their edition of the Systema Vegetabilium (1819), add what they consider fifteen good and three doubtful species to those already described since the time of Linnaeus. Of these fifteen, only one was given for the first time by them, all of the others having been previously named by various botanists since Willdenow's edition. In 1832 Fingerhuth recognized twenty-five accepted species, together with seven requiring further examination, and twenty-eight botanical varieties, three of the species and most of the varieties being named by him. In 1846 Sendtner recorded ten species and numerous varieties as occurring in Brazil alone, he having named seven of the species. In 1852, Dunal recorded fifty accepted species, of which eleven were described for the first time, together with many varieties, and eleven species requiring further examination, besides three doubtful ones.

This was the last revision of the genus, and but three new species have since been described. Altogether about ninety specific names have been given, of which the Index Kewensis recognizes fifty-four as good. Notwithstanding this large number, modern authorities generally believe that there are only a few. Professor Asa Gray, in a letter to Dr. Sturtevant under date of Nov. 2, 1887, expresses a fancy that there are only two species in the genus.* Dr. Sturtevant, who had already made a considerable study of the genus, expressed the opinion that the published species in a majority of cases were only forms, and that when these were reduced to synonyms

* Agricultural Science 2: 1. 1888.

the number of species that would be accepted by botanists would be very small.* Dr. H. H. Rusby wrote Dr. Sturtevant, April 9th, 1888, saying: "I have seen a good deal of the genus in South America and have observed a great tendency to variation. I have seen but few well distinguished forms and about these are grouped hosts, presenting every shade of variation in size, color, form, and surface-planes of fruit. There are corresponding differences in pungency and flavor, in detecting which the natives are very expert. Each man will have some cherished plant that to him is very distinct, and far superior to anything that his neighbors can boast."

In regard to the great variability of Capsicum, Professor G. S. Jenman, of the Government Botanist's Office at Georgetown, British Guiana, wrote Mr. Dewart, August 24, 1892, that the genus there presents an infinite variety, and where several kinds are grown together the fruit of particular forms is often much modified by cross-fertilization, though this apparently does not apply to all varieties. Professor J. H. Hart, Superintendent of the Botanical Department of the Royal Botanical Gardens at Trinidad, during the same year wrote Mr. Dewart as follows; "We do not make any specific distinction between the Capsicums from here for the simple reason that they degenerate so quickly to a simple form under cultivation that we cannot refer them to more than a single species. Some of the finest will in four or five generations be nothing more than 'Bird-pepper' of which the forms are as many as the days of the year."

My work mainly adds strong testimony to the observations of these gentlemen. A number of well-marked types have been preserved for centuries, and within them various forms have constantly appeared. Upon these forms, in my opinion, a large number of the so-called species have been based. I have therefore separated them into two species and preserved the well-fixed types as botanical

* Agricultural Science 2: 1. 1888.

varieties. Most of the modern garden varieties easily find classification within the types of the annual species, some of them almost exactly corresponding with the wood cuts and descriptions of some very old forms. Many of the varieties from South America and Mexico present, to my mind, sufficiently distinct characters in habit of growth and in the woodiness of the plants to justify their treatment as representatives of two species.

Primarily, the classification of the types is based on the shape of the fruit and the calyx characters, as the most closely related ones can thus be brought together. The erect and pendent fruit, the primary characters of Fingerhuth and Dunal, are equally constant, but cannot be employed primarily in this classification, as both characters appear in all but two of the types here given as botanical varieties, and hence can only be used in separating the forms within these types.

In citing prelinnean authorities* I have included only the descriptions which have been carefully studied and about which I had no doubt as to the type or form intended. The descriptions of a number are so brief and incomplete that they could not be definitely located, hence it seemed wise to omit them entirely. Most of the modern works to which I have had access and which give fairly complete descriptions are referred to unless some doubt exists as to the intention of the author.

In the selection of names for the garden varieties, the principles for the nomenclature of cultivated plants adopted by the Vegetable Committee of Experiment Station Horticulturists † and the Madison Botanical Congress ‡ have been followed. In the citation of varietal synonyms reference is made to the earliest and most complete descriptions in

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* For the full titles of works published prior to 1753, reference should be made to the catalogue of the Sturtevant Prelinnean Library.— Rept. Mo. Bot. Gard. 7: 123–209. 1896.

† Bailey, Annals of Horticulture 106–107. 1889.

‡ Proceedings of the Madison Botanical Congress 41. 27 Aug. 1893.

such seed catalogues as I have seen, except where equally satisfactory accounts were found in other publications.

The economic value of the fruit has long been known. The southern natives used it as much in ancient times as they do at present. Oviedo, who reached tropical America from Spain in 1514, particularly mentions its uses.* Chanca, physician to the fleet of Columbus in his second voyage to the West Indies, in a letter written to the Chapter of Seville in 1494, alludes to it as a condiment.† Its use for this purpose is also mentioned by subsequent writers. In Spain and India as early as the sixteenth century the fruit was employed in dressing meats and was supposed by some to be valuable for dyeing. Medicinally the red pepper was known to assist in the digestion of meats, and when mixed with honey and applied externally was a remedy for quinsy. Mention is also made of its removing freckles from the skin.‡ It was given for dropsy, colic, ague, toothache, and other ailments.§ The fruit was given to horses and mules for "dry gripes" brought on by rank and sour grass.¶ Later, a preparation of Capsicum was given in case of black vomit, and various tropical fevers,‖ and has been recommended for atonic gout, dyspepsia accompanied by flatulence, tympanitis, paralysis, cynanche maligna and scarlatina maligna.** At the present time Capsicum is employed in medicine mainly as an astringent in the form of a tincture. The ground fruit is used in combination with quinine for malarial fever. When mixed with turmeric and some spice, it forms Curry Powder. The pungency †† is due to an active principle called "cap-

* Sturtevant, American Naturalist **19**: 544. 1885.

† Flückiger & Hanbury, Pharmacography 452. 1879 [Engl. ed.].

‡ Gerarde, Herball 293. 1597.

§ Parkinson, Theat. Bot. 359. 1640.

¶ Miller, Gard. Dict. 1797 [ed. Martyn].

‖ Phillips, Cult. Veg. **1**: 118. 1822.

** Lindley, Veg. Kingdom 621. 1853.

†† The burning sensation occasioned by eating the pungent varieties may be checked by drinking milk.

saicin " which occurs mainly in the placenta and seed and which is volatile when exposed to the air. In its effects Capsicum is a stimulant, stomachic, and a rubefacient.*

Commercially the red pepper is employed more as a condiment than for any other purpose, and it is used as a seasoning in almost every dish by the inhabitants of warm climates. Cayenne Pepper is one of the important products, consisting mainly of the fruit of the small pungent varieties reduced to a fine powder. It is sometimes prepared by mixing wheat flour with the dried fruit and making into cakes with yeast. After baking until quite hard and brittle these are reduced to powder and sifted. When prepared in this manner it has been known under the name *Cayenne Pepper Pot*,† and when simply dried, powdered, and mixed with a little salt, it has been known as *Cayan Butter*.‡ According to the Encyclopaedia Britannica, *Mandram* is a West Indian stomachic prepared by mashing a few pods of bird pepper and mixing them with sliced cucumbers and shallots to which have been added a little lime-juice and Madeira wine.

There are various brands of pepper sauce, which consist chiefly of the unground fruit of the pungent varieties preserved in brine or strong vinegar. Tabasco Pepper Sauce or liquid pepper is said to be the pulp of the ripe fruit of the Tabasco variety extracted by pressure and so handled as to retain all flavor, strength, aroma and color of the ripe fruit. Tabasco Catchup is made from the same variety. Paprika is a well-known Hungarian condiment made from the fruit which is ground after the seeds have been removed, and is, therefore, much less pungent than the Tabasco sauce. Chilli con carne consists of the small pungent peppers finely ground and mixed with meat. It is much used in the Southern United States. In Mexico the fruit forms a very essential ingredient in the tamales so

* Waggaman, Bot. Mat. Med. 228. 1895.

† Phillips, Cult. Veg. **1**: 123. 1822.

‡ Miller, Gard. Dict. 1797 [ed. Martyn].

common in that country and quite well known in the Southern United States.

Many of the kinds of Capsicum are more or less employed either in pickles or in the raw or cooked state, the milder sorts being much preferred by northern consumers and the more pungent ones by the southern people. They are sliced and either mixed with salads or served like tomatoes with vinegar and salt. The thick-fleshed bell-shaped and squash varieties are much used as mangoes. These are made by cutting the fruit down one side, removing the seed, and filling with chow-chow pickles. The parts are then tied together and the whole placed in jars or cans containing vinegar where it remains until wanted. Some of the medium-sized pungent varieties are eaten by native Mexicans in the raw state, the same as radishes. I am told by a reliable firm, who manufacture pepper sauce, that in Spain some of the large sweet varieties, which with us are often stuffed and baked, are canned after being cooked in olive oil, and are then eaten with French salad dressing without further cooking. In this condition, too, the fruit is often employed in stuffing pitted olives.

Aside from its value as a food and a medicine, Capsicum has been recommended as an insecticide when used in connection with tobacco-paper,* but inasmuch as the operation was not a success without the latter it is probable that tobacco was the essential ingredient. The seed is considered a very healthful bird food, and is used to some extent for that purpose.

In Europe, some varieties, such as Little Gem and Prince of Wales, are grown considerably for decorative purposes, especially in pots, under glass.

The culture of the pepper is comparatively simple. It does not require special care and yet quickly responds to any particular attention which may be given it. A warm and moderately light soil that does not quickly dry out appears to be the best. The seed generally requires from

* Gard. Chron. 150. 1852.

twelve to twenty days to germinate, the exact time depending upon its age. The plants are usually started under glass in February or March and transplanted into pots or flats when large enough to handle. After all danger of frost is past, they are moved to the field and planted one or two feet apart. The ground around the plants is thoroughly cultivated during the growing season, and in case of extreme drouth artificial irrigation is sometimes resorted to.

Its culture does not appear to be especially confined to any particular locality but is generally distributed throughout temperate and tropical regions for the supply of local markets. *Capsicum frutescens* is confined mostly to Southern Asia, Africa, Mexico, and South and Central America. The large Sweet Spanish variety is largely cultivated in Spain, and various varieties for the manufacture of Paprika are extensively grown in Hungary. The Tabasco variety is almost exclusively confined to one locality in Louisiana. There is considerable local demand, as pickles, mangoes and pepper sauces are quite extensively manufactured in St. Louis, and the supply for them is largely grown in this vicinity.

Fortunately peppers are not subject to attack by insects. Red spider and greenfly (*Aphis*) are the only known Arthropod enemies, and their depredations are confined mainly to plants grown under glass. The red spider may be kept in check by repeatedly syringing with water, and the greenfly may be killed by fumigating with tobacco.

There are two fungus diseases which frequently occur, especially upon the larger thick-fleshed varieties. One of them Dr. Halsted * calls an anthracnose of the pink sort, due to *Gloeosporium piperatum* E. & E., which causes the fruit to rot about the time it is maturing. The other disease is a dark anthracnose, due to *Colletotrichum nigrum*.†

* Rept. N. J. Exp. Sta. 326. 1892.

† Halsted, Bull. Torrey Bot. Club 18: 15. 1891.

ARTIFICIAL KEY TO GARDEN PEPPERS.

* Peduncles straight; fruit erect or spreading.

+– Calyx embracing base of fruit, the latter much longer than broad.

++ Fruit short, usually less than 1½ in. long; peduncles nearly as long or longer.

Plant 2½ ft. or more high, maturing slowly and rarely ripening fruit except in extreme south. *C. frutescens.*

Plant ripening its fruit earlier, usually not over 1½ ft. high except for the first variety. *C. annuum conoides.*

Fruit usually compressed at the base by the calyx; plant at least 2 ft. high. TABASCO.

Fruit not compressed at the base by the calyx.

Dark red.

Oblong fusiform. CORAL GEM.

Conical or ovate obtuse. CAYENNE.

Orange red. ORANGE-RED CLUSTER.

++ ++ Fruit usually more than 1½ in. long, slender, largest diameter usually less than ½ in.; peduncles shorter; flesh very thin (about $\frac{1}{24}$ in.).

Plant about 1 ft. high; leaves and fruit fascicled. *C. annuum fasciculatum.*

Fruit red. RED CLUSTER.

Fruit yellow. YELLOW CLUSTER.

Plant larger; leaves and fruit not fascicled. *C. annuum acuminatum.*

Fruit red. CHILLI.

Fruit yellow. YELLOW CHILLI.

+– +– Calyx not usually embracing base of fruit, or only obscurely so; fruit usually more than 1½ in. long, largest diameter usually more than ½ in.; flesh somewhat thicker. *C. annuum longum.*

Petals more or less purple; fruit black at first, becoming orange-red. BLACK NUBIAN.

Petals white; fruit green, becoming red when ripe. LONG RED.

+–+–+– Calyx not embracing base of fruit, the latter slightly longer than broad, subconical, ovate, or oblong, usually ¾ in. to 2 in. long. *C. annuum abbreviatum.*

Fruit bright red when ripe.

Changing from green to light yellow or straw color before ripening, subrugose, not turbinate.

Usually mucronate, oval. KALEIDOSCOPE.

Not mucronate, subconical. CELESTIAL.

Not changing to light yellow.

Very rugose, often turbinate. RED WRINKLED.

Neither rugose nor turbinate. ETNA.

Fruit yellow when ripe.
With longitudinal furrows, rarely turbinate.
PRINCESS OF WALES.
Not furrowed, usually very rugose and turbinate.
YELLOW WRINKLED.

‡‡ Calyx not embracing base of fruit, the latter spherical or heart-shaped, smooth. *C. annuum cerasiforme.*
Fruit usually less than ½ in. in diameter.
Red. LITTLE GEM.
Yellow. PRINCE OF WALES.
Fruit usually ½ in. to 1 in. in diameter.
Round or cherry shaped.
Red. CHERRY.
Yellow. YELLOW CHERRY.
Heart-shaped.
Red. OXHEART.
Yellow. YELLOW OXHEART.

‡‡+ Calyx not embracing base of fruit, usually seated in a basal depression. *C. annuum grossum.*
Fruit red, subconical or prismatic. BRAZILIAN UPRIGHT.
Fruit yellow. GOLDEN UPRIGHT.

** Peduncles curved or recurved; fruit pendent.

+ Calyx embracing base of fruit, the latter much longer than broad.

++ Fruit very slender, usually less than ½ in. in diameter; flesh very thin (about $\frac{1}{24}$ in.). *C. annuum acuminatum.*
¾ to 1½ in. long.
Red. NEPAL CHILLI.
Yellow. YELLOW NEPAL CHILLI.
1½ to 4 in. long.
Red. LONG CAYENNE.
Yellow. LONG YELLOW CAYENNE.

++ ++ Fruit stouter; flesh thicker, often furrowed longitudinally.
IVORY TUSK.

+ + Calyx not embracing base of fruit, the latter much longer than broad, mostly stout, tapering. *C. annuum longum.*
Petals purple; fruit black at first, becoming orange-red.
BLACK NUBIAN.
Petals white; fruit red or yellow.
Calyx usually not entirely covering the flat base of fruit.
Flesh about ⅛ in. thick, only slightly pungent.
COUNTY FAIR.
Flesh thinner, very acrid pungent; fruit slender for the group. LONG RED.
Calyx usually covering the base, but at most obscurely embracing it.
Fruit red. CARDINAL.
Fruit yellow. LONG YELLOW.
Calyx usually seated in a basal depression.
Apex distinctly 3 to 4 lobed. ELEPHANT'S TRUNK.
Apex pointed or obscurely lobed. PROCOPP'S GIANT.

± + Calyx not embracing base of fruit, usually seated in a basal depression; fruit swollen, angular. *C. annuum grossum.*

Fruit subconical, decidedly tapering. EMPEROR.

Fruit prismatic or subconical, slightly tapering to a 3 to 4 lobed apex.

Subconical. MONSTROUS.

Prismatic. SWEET SPANISH.

Fruit squarish, subtruncate, about as long as broad.

Apical end usually much contorted, often larger than base; fruit 2 to 3 in. in diameter. BELL.

Apical end not usually contorted, but quite uniformly lobed; fruit larger than last.

Red. SWEET MOUNTAIN.

Yellow. GOLDEN DAWN.

Fruit squarish, subtruncate, longer than broad, deeply furrowed and lobed, 5 to 7 in. long, 3 to 4 in. in diameter.

Red. RUBY KING.

Yellow. GOLDEN KING.

Fruit 2 to 3 in. broad, very oblate.

Red. SQUASH.

Yellow. YELLOW SQUASH.

± ± Calyx not embracing base of fruit, the latter slightly longer than broad, subconical, ovate, or oblong, usually ¾ in. to 2 in. long. *C. annuum abbreviatum.*

Fruit bright red when ripe.

Changing from green to bright yellow or straw color before ripening, subrugose, not turbinate.

Oval, usually mucronate. KALEIDOSCOPE.

Not changing to light yellow, very rugose, often turbinate. RED WRINKLED.

Fruit yellow when ripe.

Longitudinally furrowed, rarely turbinate. PRINCESS OF WALES.

Not usually furrowed, very rugose, turbinate. YELLOW WRINKLED.

± ± + Calyx not embracing base of fruit, the latter spherical or heartshaped, smooth, usually ⅝ in. to 1¼ in. in diameter. *C. annuum cerasiforme.*

About ⅝ in. in diameter, yellow. PRINCE OF WALES.

Round or cherry shaped, ½ to 1¼ in. in diameter.

Red. CHERRY.

Yellow. YELLOW CHERRY.

Heartshaped.

Red. OXHEART.

Yellow. YELLOW OXHEART.

Synopsis.

A Herbaceous or suffrutescent, annual or biennial.

C. ANNUUM L.

Capsicum annuum Linn. Hort. Cliff. 59. 1737.

Herbaceous or suffrutescent plants usually growing two or three feet high, sometimes four or five, rarely only a foot, with numerous erect angular branches usually rising from near the ground, generally smooth, sometimes sparsely pubescent. Leaves medium small to very large, ovate acuminate to oblong elliptical; petioles smooth or sparingly hairy. Peduncles solitary, sometimes in twos, usually smooth. Corolla white or dingy white, except in one variety when it is more or less blotched with purple. Fruits variable in size, color and form.

This species furnishes all the leading commercial varieties now in cultivation. In temperate latitudes they are treated as annuals, while in tropical countries some varieties are biennial or perennial.

a Fruit oblong linear.

* Calyx usually embracing base of fruit.

+ Fruit usually less than 1½ in. long; peduncles about as long or longer.

C. annuum conoides (Miller).

Capsicum conoides Miller, Gard. Dict. 1771 [no. 8. ed. 6].— Linn. Syst. **4**: 562. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. Gen. Capsici 14. *t. 3. f. b.* 1832.— Don, Hist. Dich. Pl. **4**: 446. 1838.— Rich. Fl. Abyss. **2**: 96. 1851.— Dunal in DC. Prodr. **13**[1]: 414. 1852.— Seemann, Bot. Herald 402. 1852–57.—Miquel, Fl. Ned. Ind. **2**: 659. 1856.

Capsicum conoides sulcatum Fingerh. Monogr. 15. *t. 3. f. c.* 1832.— Dunal in DC. Prodr. **13**[1]: 415. 1852.

Capsicum conoides chordale Fingerh. l. c. *f. d.*— Dunal, l. c.

Capsicum conoides oblongo-conicum Dunal, l. c.

Piper oblongum, exiguum erectum pyramidale. Greg. de Reg. in Clus. Cur. Post. 97, *f. 4*, 98. 1611.— Jonstonus, Dendrog. *t. 56.* 1662.— Raius, Hist. Pl. **1**: 677. 1686.

Piper Indicum siliquis surrectis & oblongis diff. 3. majus et minus (excl. majus). Bauhin. Pinax 103. 1623.

Capsicum exiguum erectum pyramidale. Parkinson, Theat. Bot. 357. *f. 6.* 1640.

Capsicum minus fructu parvo pyramidali erecto. Sloane, Cat. Pl. Jam. 112. 1696.

Capsicum sive Piper Indicum oblongum minus. Morison, Hist. Pl. Oxon. 3: 529. 1699.

Capsicum siliquis surrectis & oblongis, exiguus. Tournef. Inst. 152. 1700.

Piper Indicum minimum erectum. [Beslerus], Hort. Eyst. 1. Autumn. Ord. 1: 8. *f. 1.* 1713.

Solanum mordens minus erectum. Weinmann. Phyt. Iconog. 4: 349. *pl. 930. f. b.* 1745.

Negro-pepper. Hughes, Hist. Barb. 213. 1750. Fide Maycock, Fl. Barb. 104. 1830.

Capsicum fructu minimo conico rubro. Browne, Hist. Jam. 176. 1756.

Plants suffrutescent, 1–2½ ft. high, diffusely spreading 1½–2 ft. Stem and lower branches striate, green, sparingly corky. Branches short between the nodes, often subpubescent. Leaves numerous, ovate lanceolate, acuminate, pubescent on midvein below, sparsely pubescent above, 2–3 in. long, ¾–2 in. wide, rarely larger, quite erect, smooth or subscabrous, usually rather dark green; petioles ⅜–⅝ in. long, rather slender, pubescent or subglabrous. Peduncles solitary or often in twos, usually slender, stiff, straight, erect, slightly enlarged toward the calyx end. Calyx obconical or cup-shaped, usually embracing base of fruit; teeth obscure. Corolla greenish white, small, spreading ⅜–⅝ in. Fruit erect, subconical or oblong cylindrical, acuminate or obtuse, usually shorter than the peduncles, ¾–1¼ in. long, ¼–½ in. diam., 2–3 celled, red or yellow, sometimes blotched with purple before ripening, mostly borne above the leaves; flesh about $\frac{1}{24}$ in. thick, extremely pungent.

Coral Gem.* The habit of growth of this variety is, apparently, subject to extreme variation in different localities, the plant in some places making a tender growth of not more than a foot, while in other places it attains a height of 2 ft. In the former case the branches are light green, quite flexible, frequently decumbent with numerous upright middle shoots, forming a rosette-like mass, and

* Vaughan, Cat. 1889.

the leaves but slightly darker on the upper surface than below. The larger growing plants are stouter and more branchy. Fruit usually slender, fusiform, smooth, extremely pungent, red, sometimes blotched with brown before ripening, usually scattered so thickly over the plant as to give the appearance of a bouquet of corals.—Plate 9, f. 2.

TABASCO.* Plant usually about 2½ ft. high, with an erect spreading habit. Leaves often 4 in. long by 2½ in. wide, dark green, usually distinctly pubescent along the veins. Fruit oblong cylindrical, obtuse or acute, usually compressed at the base by the calyx, deep red when ripe, the unripe ones often drying to an orange color, more frequently borne in twos than in other varieties of this group.

CAYENNE.† Plant more woody than others. Branches fewer but more erect, and quite rigid. Leaves deep green on upper surface, decidedly paler below. Calyx occasionally seated on base of fruit. Fruit usually as long as or slightly longer than the penduncles, subconical or ovate, obtuse, about 1¼ in. long, ½ in. diam., at first green, changing to blackish, then yellowish-red, finally red.

ORANGE-RED CLUSTER.‡ Plants usually with a flattish top. Branches slender but rigid, purple striate, and decidedly purple at nodes. Leaves smooth, quite erect, very dark green on upper surface, much paler below. Fruit 1–1¼ in. long, about as long as or longer than peduncles, very rigidly erect, standing prominently above the leaves, of a beautiful orange-red color. The great number of fruits equally distributed over the symmetrical plant make it one of the most ornamental varieties.—Plate 9, f. 3

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* Described from Dr. Sturtevant's notes and herbarium specimens. Seed received by him from McIlhenny of New Iberia, La., 1888.

† Hovey, Seed Cat. 1888.—Described from Dr. Sturtevant's notes and herbarium specimens. Seed received by him from Livingston, Columbus, O., 1888, who listed it as *Cayenne of Commerce*, in contrast with the *Long Cayenne*.

‡ Listed in Haage & Schmidt, Seed Cat. 15, 1893, under the German name *Orangerother Trauben-Pfeffer*.

+- Fruit usually more than 1½ in. long; peduncles shorter.
++ Leaves and fruit fascicled; fruit erect.

C. annuum fasciculatum (Sturt.).

Capsicum fasciculatum Sturtevant, Bull. Torrey Bot. Club **15**: 133. 1888.

"Stems smooth, green, round, subverrucose, swollen at the branchings and purple, dichotomous or trichotomous. Branches angular, few, erect-spreading, green, purple at insertion of petioles, subpubescent, bearing the leaves for the most part clustered or bunched at the swollen summits. Leaves spreading, crowded into bunches, nearly of one size, the larger ones 3¾ in. by 1⅛ in., usually 3 in. by ¾ in., elliptical-lanceolate, pointed at both ends, from the base extending equally into the petiole, deep green above, paler below, the middle nerve distinct; slightly scabrous, entire or subrepand; borne almost entirely in a confused mass along with the berries at the summit of branches, very rarely lower down. Petioles smooth, nearly as long as, or sometimes even longer than the leaves, slender, margined by the extension of the leaf blade. Peduncles smooth, angular, thickish, erect, enlarging towards calyx end, rather long, 1½ in., grouped in clusters rather confusedly with the leaves, but the tendency of the grouping seeming to be in twos or threes, axillary or extra-axillary. Calyx cyathiform, embracing base of fruit, obscurely ten or twelve-nerved (5 or 6 distinct), subpentagonal, subtruncate, five or six-toothed, the teeth acute, erect, smooth. Corolla white, quite large, about ⅞ in. in diameter, the divisions very long and narrow, often twisted. Berry cylindro-conical, straight or curved, about 3 in. long, by ¼ in. diameter, or smaller, usually rugose, sometimes smooth, at first a shining green, then red; two-celled; the placenta thick at the base; acrid.

"This species differs principally from *Capsicum annuum*, Fingerhuth, by the round stem; pubescent and dichotomous or trichotomous branchings; freedom from lower leaves; the leaves clustered at summits; all of one size and

nearly or quite lanceolate; petioles as long as the leaves; the clustered peduncles; the white corolla with deep and narrow lacineæ, and the shining green of the unripe berry. The aspect of the plant is very distinct, the dark green lanceolate leaves closely clustered and so dense as to overlap, the low and spreading compact, bush-like appearance, the fruit crowded with the leaves, the bare and knobby-looking stems where exposed to view. As grown by me the plant was 1–1½ ft. high, and ripened its berries in September of the year when sown." *

Red Cluster.† This variety, and its yellow form, are the only ones included in this group. Professor Bailey alludes to it as one of the most distinct of any he ever grew.‡ Catalogue descriptions sometimes allude to it as a form, or sport, from Chilli. This is evidently true, as variations toward the Chilli type have often been observed.— Plate 9, f. 4.

Yellow Cluster.§ Identical with the preceding except that the fruit is of a bright yellow color.

↔ ↔ Leaves and fruit not fascicled.

C. annuum acuminatum Fingerh.

Plants herbaceous or suffrutescent, 1½–2½ ft. high, spreading 1½–2 ft. Branches numerous, erect or spreading, bearing a dense mass of foliage. Leaves solitary, sometimes semifascicled, 2–3½ in. long, 1–2 in. wide, avg. about 1⅛ by 2¾ in., ovate acuminate, deep green on upper surface, much paler below, sparsely pubescent on veins below; margins subciliate especially on younger leaves; petioles medium stout, ¾–1 in. long, generally smooth. Peduncles slender, enlarging toward calyx end. Calyx

* Original description of the species *fasciculatum*.

† Burpee, Cat. 1889.— *Japan Cluster*. Dreer, Cat. 1891.— French, *Piment à bouquet rouge*.— German, *Rother Trauben-Pfeffer*.— Japanese, *Tenjikumamori*, according to Sturtevant, l. c.

‡ Bull. Mich. Agr. Coll. 31: 38. Nov. 1887.

§ Haage & Schmidt, Cat. 1893.— German, *Gelber Trauben-Pfeffer*.

usually embracing base of fruit. Corolla medium, spreading $\frac{1}{2}$–$\frac{3}{4}$ in., dingy white. Fruit very slender, $\frac{1}{2}$–$4\frac{1}{2}$ in. long, $\frac{1}{4}$–$\frac{3}{8}$ in. diam., smooth or subrugose, usually more or less curved, 2-celled; flesh very thin, about $\frac{1}{24}$ in. thick, extremely pungent, red or yellow. The long fruit of this and the preceding variety is sometimes called finger-pepper.

= Fruit erect.

CHILLI.* Plants about $2\frac{1}{2}$ ft. high, very branchy. Fruit borne about even with the leaves, at first a shining green afterwards becoming coral red, 2–3 in. long, nearly straight, smooth or subrugose; base sometimes slightly compressed by the calyx. This differs from Chili as described by Burr † in having shorter and erect fruit. Dr. Sturtevant's notes indicate both pendent and erect forms. Plants grown by us from seed of many sources produced almost

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* *Red Chili.* Hovey, Cat. 1889.— *Chili Pepper.* Burr, Field & Gard. Veg. 622. 1863.— *Long Cayenne.* Hend. Cat. 1884.— *Chili Pepper*, or *Chillies.* Vilmorin-And. Veg. Gard. 151. 1885 [Eng. ed. Robinson].— *Chili.* Bailey, Bull. Mich. Agr. Col. 31: 38. 1887.—French, *Piment du Chili.*— German, *Chilenischer scharfer Pfeffer.*

Capsicum conicum Meyer, Fl. Esseq. 112. 1818.— Linn. Syst. **4**: 809. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. Gen. Capsici 16. 1832.—Don, Hist. Dich. Pl. **4**: 445. 1838.—Dunal in DC. Prodr. **13**^{1}: 415. 1852.

Capsicum annuum acuminatum Fingerh. Monogr. Gen. Capsici 13. *t. 2. f. c.* 1832.— Dunal in DC. Prodr. **13**^{1}: 412. 1852.

Capsicum conicum orientale. Dunal, l. c. 415.

Capsicum Chilense Hort. Vilmorin-And. Fl. Pleine Terre 885. 1870 [3d ed.].

Piper Indicum surrectis corniculis. Camerar. Hort. Med. 127. 1588.

Piper Indicum siliquis surrectis & oblongis. diff. 1. Pyramidale majus. 2. pyramidale minus. Bauhin. Pinax 102. 1623.

Capsicum siliquis surrectis & oblongis, brevibus. Tournef. Inst. 152. 1700.— Miller, Gard. Dict. 1771 [ed. 6].

Piper Indicum medium longum erectum. Hort. Eyst. **1**. Aut. Ord. 1:11. *f. 2.* 1713.

Capsicum surrectum, medium Styli forma. Tillus, Cat. Pl. Pisa. 30. 1723.

Solanum mordens fructu longo erecto. Weinmann. Phyt. 349. *t. 928. f. e.* 1745.

† Burr, Field and Gard. Veg. 611. 1865.

invariably erect fruit, and the few pendent ones properly belonged to the Long Cayenne variety.— Plate 10, f. 1.

YELLOW CHILLI.* Fruit usually more pyramidal in shape than the preceding, usually thicker and averaging somewhat shorter, otherwise differing only in being of a bright yellow color.— Plate 10, f. 2.

= = Fruit pendent.

LONG CAYENNE.† Plant vigorous, 1½–2½ ft. high. Branches numerous, medium stout, green, erect or upright.

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* Seed from Professor L. H. Bailey, Cornell University, 1892.

Capsicum pyramidale Miller, Gard. Dict. 1771 [no. 7. ed. 6].— Linn. Syst. **4**: 563. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. l. c. 15. *t. 3. f. e.* 1832.—Don, Hist. Dich. Pl. **4**: 446. 1838.—Dunal in DC. Prodr. **13**¹: 414. 1852.— Miquel, Fl. Ned. Ind. **2**: 661. 1856.

Capsicum torulosum Hornem. Hort. Hafn. Suppl. 27. 1819. Fide Index Kewensis.

Capsicum pyramidale torulosum Fingerh. Monogr. 15. 1832.— Dunal in DC. Prodr. **13**¹: 414. 1852.

Capsicum pyramidale longicorne Dunal, l. c.

Capsicum minus flavum. Rumph. Herb. Amb. **5**: 248. *t. 88. f. 3.* 1747.

Capsicum siliquis surrectis & oblongis brevibus. Miller, Gard. Dict. 1771 [ed. 6].

† Vilmorin-And. Veg. Gard. 151. 1885 [Eng. ed. Robinson].— *Cayenne.* Bailey, Bull. Mich. Agr. Col. 31: 38. 1887.— French, *Piment de Cayenne.*

Capsicum longum DC. ex Fingerh. Monogr. Gen. Capsici 23. *t. 6. f. d.* 1832.

Capsicum longum ceratoides recurvum Dunal in DC. Prodr. **13**¹: 424. 1852.

Capsicum longum Cayennense Hort. Vilmorin-And. Fl. Pleine Terre 884. 1870 [3d ed.].

Siliquastrum tertium. Fuch. Hist. Stirp. Basil. 733. *f.* 1542.

Capsicum oblongius. Fuch. Hist. Stirp. Basil. 426. *f.* 1545.

Siliquastrum oblongius. Fuch. Hist. Stirp. Lugd. 693. *f.* 1551.

Capsicum recurvis siliquis. Dodon. Hist. Stirp. Pempt. 704. *f.* 1583; 716. *f.* 1616.— Magnol, Hort. Monsp. 41. 1697.— Tournef. Inst. 152. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.— Boerhaave, Index Pl. Lugd.-Bat. **2**: 68. 1727.— Miller, Gard. Dict. 1731 [no. 2].

Piper Indicum. Camerar. Pl. Epit. 347. *f.* 1586.

Siliquastrum varietas longum. Camerar. Pl. Epit. 348. *f.*° 1586.

Leaves medium, dark green, 1¾–3 in. long, 1–1¼ in. wide; petioles medium, ⅞–1½ in. long. Peduncles solitary, medium stout, 1–1½ in. long, curved or recurved. Corolla white, spreading ¾–1¼ in. Fruit 3–4 in. long (rarely more), ¼–⅜ in. diam., pendent, oblong acuminate, usually subrugose and more or less curved, usually transversely furrowed; flesh very thin and extremely pungent.— Plate 11, f. 3.

The earlier catalogue accounts of Cayenne, True Cayenne, or Small Cayenne, refer to another variety, here called Cayenne. Vilmorin mentions Long Cayenne as a subvariety of Long Red and belonging to a different botanical species from the True Cayenne.

Long Yellow Cayenne.* Identical with the preceding except that the fruit is of a bright yellow color.— Plate 12, f. 1.

Capsicum siliquis longis recurvis. Bauh. Phyt. 155. 1596.

Piper longum minus siliquis recurvis. Greg. de Reg. in Clus. Cur. Post. 101, *f. 10*, 102. 1611.— Jonstonus, Dendrog. *t. 56*. 1662.

Piper Calecuticum, sive Capsicum oblongius. Bauhin. Hist. Pl. Ebrod. 2: 943. 1651.

Chilli, Piper siliquosum Mexicanum. Hernand. Nov. Hist. Romae 1: 135. 1651.

Siliquastrum. Pancovius, Herb. *f. 296*. 1673.

Piper Capsicum. Chabraeus, Sciag. 297. *f.* 1677.

Solanum Capsicum dictum, propendentibus siliquis oblongis recurvis. Hermann. Hort. Acad. Lugd.-Bat. 576. 1687.

Capsicum sive Piper Indicum minus siliquis recurvis. Morison, Hist. Pl. Oxon. 3: 529. 1699.

Solanum, urens siliqua propendente rubra. Morison, l. c. Sect. 13. *t. 2. f.* 1699.

Capsicum siliquis recurvis, minus. Tournef. Inst. 152. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.— Boerhaave, Index Pl. Lugd.-Bat. 2: 68. 1727.

Piper Indicum minus recurvis siliquis. Hort. Eyst. 1. Aut. Ord. 1: 6. *f. 2*. 1713.

Solanum mordens siliquis oblongis recurvis. Weinmann. Phyt. 349. *t. 927. f. d*. 1745.

* Henderson, Cat. 1884.

Capsicum longum luteum Fingerh. Monogr. *t. 7. f. b*. 1832.

NEPAL CHILLI.* Plants not distinguishable from Long Cayenne, of which it is probably a subvariety. Calyx occasionally not embracing base of fruit. Fruit $\frac{1}{2}$–$1\frac{1}{4}$ in. long, $\frac{1}{4}$–$\frac{3}{8}$ in. diam., oblong, cylindrical, or obtusely conical, smooth or often with a transverse depression on one side near the apex. Often varies so as to be almost identical with Long Cayenne.— Plate 11, f. 1.

YELLOW NEPAL CHILLI.† Identical with the preceding except that the fruit is of a bright yellow color.

* * Calyx not usually embracing base of fruit except in the Ivory Tusk variety.

C. annuum longum Sendt.

Capsicum annuum Linn. Fl. Zeyl. 38. 1747; Hort. Upsal. 47. 1748; Sp. Pl. 188. 1753.—Gouan, Hort. Reg. Monsp. 111. 1762.— Miller, Gard. Dict. 1771 [no. 1. ed. 6].— Aublet, Hist. Pl. Guiane **1**: 219. 1775.— Linn. Syst. 226. 1784 [ed. 14. Murray].— Thunb. Fl. Japon. 93. 1784.— Loureiro, Fl. Cochin **1**: 127. 1790; **1**: 157. 1793 [ed. Willd.].— Gaertn. Fruct. et Sem. **2**: 241. 1791.— Lamarck, Enc. Meth. **2**: 26. 1793 [no. 2388].— Linn. Sp. Pl. **1**: 1050. 1797 [ed. Willd.].—Miller, Gard. Dict. 1797 [ed. Martyn]. (In part).— Desfont. Fl. Atlant. **1**: 196. 1798–1800.— Poiret, Enc. Meth. **5**: 324.

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* Seeds of this variety and of the *Yellow Nepal Chilli* were received from Saharanpur Garden in India in 1895. They are not known in cultivation in this country.

Capsicum pendulum Willd. Enum. Hort. Pl. Reg. Berol. 242. 1809.— Hornem. Hort. Hafn. **1**: 224. 1813.— Linn. Syst. **4**: 562. 1819 [ed. Röm. et Schult.].—Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. 25. *t. 7. f. d.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**^{1}: 425. 1852.

Capsicum pendulum minus Fingerh. Monogr. 25. 1832.— Dunal in DC. Prodr. **13**^{1}: 425. 1852.

Capsicum pendulum torulosum Fingerh. l. c.— Dunal, l. c.

Capsicum pendulum majus. Dunal, l. c.

† *Capsicum Sinense* Linn. Syst. 226. 1784 [ed. 14. Murray].— Lam. Enc. Meth. **2**: 26. 1793 [no. 2394].—Linn. Sp. Pl. **1**: 1051 [ed. Willd.].— Miller, Gard. Dict. 1797 [ed. Martyn].— Poiret, Enc. Meth. **5**: 326. 1804.— Persoon, Syn. Pl. **1**: 229. 1805.— Hornem. Hort. Hafn. **1**: 224. 1813.— Linn. Syst. **4**: 564. 1819 [ed. Röm. et Schult.].—Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. 26. *t. 8. f. d.* 1832.— Dunal in DC. Prodr. **13**^{1}: 425. 1852.

Capsicum curvipes Dunal, l. c. 423.

1804.—Persoon, Syn. Pl. **1**: 229. 1805.— Hornem. Hort. Hafn. **1**: 223. 1813.—Meyer, Fl. Esseq. 112. 1818.— Linn. Syst. **4**: 559. 1819 [ed. Röm. et Schult.].—Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Moon, Cat. Pl. Ceylon 16. 1824.— Weyhe & Nees von Esenbeck, Pl. Offic. **1**. *pl. 190.* 1828.— Roxb. Fl. Ind. **1**: 573. 1832.— Fingerh. Monogr. Gen. Capsici 12. *t. 2. f. a.* 1832.—Don, Hist. Dich. Pl. **4**: 444. 1838.—Sendt. in Martius, Fl. Bras. **10**: 147. 1846.—Hooker, Niger Fl. 472. 1849.— Dunal in DC. Prodr. **13**[1]: 412. 1852.— Miquel, Fl. Ned. Ind. **2**: 657. 1856.—Drury, Useful Pl. Ind. 111. 1858.—Reichenb. Ic. Fl. Germ. **20**. *pl. 13. f. 2.* 1862.— Miquel, Mus. Lugd.-Bat. **3**: 117. 1867.— Hemsley, Biol. Cent.-Am. **2**: 423. 1881-2.

Capsicum Tournefortii Bess. Cat. Hort. Crem. 27. 1811. Fide Index Kewensis.

Capsicum annuum ovoideum Fingerh. Monogr. Gen. Capsici 14. *t. 2. f. e.* 1832.—Dunal in DC. Prodr. **13**[1]: 412. 1852.

Capsicum annuum subangulosum Fingerh. Monogr. Gen. Capsici 13. *t. 2. f. d.* 1832.

Capsicum annuum longicarpum Don, Hist. Dich. Pl. **4**: 445. 1838.

Capsicum annuum longum Sendt. in Martius, Fl. Bras. **10**: 147. 1846.— Kuntze, Revis. Gen. Plant. 449. 1891. (As to races with refracted fruit.)

Capsicum annuum erectum Kuntze, Revis. Gen. Plant. 449. 1891.

Siliquastrum majus et minus. Fuch. Hist. Stirp. Basil. 731-732. *f.* 1542; Hist. Stirp. Lugd. 693. *f.* 1551.

Capsicon rubeum & nigrum. Fuch. Hist. Stirp. 425. *f.* 1545.

Piper Indicum, sive Siliquastrum. Pinaeus, Hist. Pl. Lugd. 12. 1561.

Piper Indicum. Matth. Comment. 23. *f.* 1560; 400. *f.* 1570. Compend. Pl. Omnib. 322. *f.* 1571. Matth. Opera 434. *f.* 1598.— Blackw. Herbarium **2**. *pl. 129.* 1754.

Capsicum, Piper Indicum. Lobel, Pl. Stirp. Hist. Antv. 172. 1576.

Capsicum oblongioribus siliquis. Dodon. Stirp. Hist. Pempt. 704. *f.* 1583; 716. *f.* 1616.

Siliquastrum. Bassaeus, Eicones Pl. 859. *f.* 1590.—Tabern. Kreuterbuch 529. *f.* 1591; Volk. Kreuterbuch **2**: 559. *f.* 1613.

Capsicum Actuarij, sive Caninum Zinziber. etc. Lobel. Icones Stirp. 316. 1591.

Capsicum. Clus. in Monard. Simplic. Med. 387. 1593.— Monardus in Clus. Exot. 340. *f.* 1605.

Capsicum siliquis oblongis. Bauhin. Phytopinax 155. 1596.

Capsicum longioribus siliquis. Gerarde, Herball 292. *f. 1.* 1597; 364. *f. 1.* 1636.

Piper Americanum vulgatior. Greg. de Reg. in Clus. Cur. Post. 103. *f.* 1611.

Piper oblongum recurvis siliquis. Greg. de Reg. in Clus. Cur. Post. 101. *f. 9.* 1611.— Jonstonus, Dendrog. *t. 56.* 1662.— Raius, Hist. Pl. **1**: 678. 1686.

Piper Indicum longum maximum. Hort. Eyst. 1613 [*fide* Morison, Pl. Hist. Oxon. **3**: 529. 1699]; **1**. Aut. Ord. **1**: 6. *f. 1.* 1713.

Solanum urens siliqua propendente rubra. Morison, l. c. Sect. 13. *t.* **2**. *f.* 2.

Piper Indicum propendentibus siliquis oblongis recurvis. Bauhin. Pinax 102. 1623.

Piper Indicum vulgatissimum. Bauhin. Pinax 102. 1623.— Morison, Hist. Pl. Oxon. **3**: 528. 1699.

Capsicum oblongum minus recurvis siliquis. Parkinson, Theat. Bot. 357, *f. 16*, 358. 1640.— Sloane, Cat. Pl. Jamaic. 113. 1696.

Capsicum majus vulgatius oblongis siliquis. Parkinson, Theat. Bot. 355, 356. *f. 1*. 1640.— Magnol, Hort. Monsp. 41. 1697.

Capsicum oblongum majus recurvis siliquis. Parkinson, Theat. Bot. 357, *f. 15*, 358. 1640.

Capsicum erectum majus longum. Parkinson, Theat. Bot. 358. 1640.

Figures without name, in Hernand. Nov. Hist. Pl. **1**: 135–137. 1651.

Piper Indicum longiorib. siliquis rubr. Sweert. Florilegium **2**: *t. 35. f. 3*. 1654.

Piper longum majus surrectum. Jonstonus, Dendrog. *t. 56*. 1662.

Piper vulgatissima. Jonstonus, Dendrog. *t. 56*. 1662.

Capsicum Brasilianum fructu oblongo. Munting, Waare Oeffen. 341. 1682.

Solanum Capsicum dictum siliquis surrectis & oblongis. Hermann. Hort. Acad. Lugd.-Bat. 576. 1687.

Solanum Capsicum dictum vulgatissimum. Hermann. Hort. Acad. Lugd.-Bat. 574. 1687.

Capsicum siliquis surrectis & oblongis. Magnol, Hort. Monsp. 42. 1697.

Capsicum sive Piper Indicum siliquis oblongis recurvis. Morison, Pl. Hist. Oxon. **3**: 529. 1699.

Capsicum sive Piper Indicum siliquis surrectis & oblongis. Morison, Pl. Hist. Oxon. **3**: 530. 1699.

Capsicum siliquis longis, propendentibus. Tournef. Inst. 152. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.— Miller, Gard. Dict. 1731 [no. 1].

Piper Indicum medium. Hort. Eyst. **1**. Aut. Ord. 1: 7. 1713.

Capsicum; fructu oblongo, nunc erecto, nunc nutante, rubro. Miller, Gard. Dict. 1731 [no. 9].

Capsicum. Piper indicum. Blackw. Herbal **1**. *pl. 129*. 1737.

Solanum mordens medium. Weinmann. Phyt. **4**: 349. *t. 927. f. e.* 1745.

Plants quite erect, stalky, $1\frac{1}{2}$–$2\frac{1}{2}$ ft. high, tree like. Stem green, sparingly hairy, stout. Branches few, large, quite erect, green, purplish at nodes, often purplish striate, sparsely pubescent. Leaves ovate acuminate, deep green, $2\frac{1}{2}$–4 in. long, $1\frac{1}{2}$–$2\frac{1}{2}$ in. wide, slightly hairy on midrib below; lower ones often pendent, sometimes involute and more or less wrinkled; upper ones smoother and more erect; petiole large, smooth, sometimes longer than blade.

Peduncles solitary, curved or straight either on the same or on different plants, $\frac{7}{8}$–$1\frac{1}{8}$ in. long, stout, enlarging toward calyx end. Calyx usually pateriform or funnelform, rarely embracing base of fruit except in the Ivory Tusk variety, though sometimes where the calyx is slightly larger than the base the fruit is obscurely inclosed by the margin of the calyx. Corolla large, dingy white, spreading $\frac{7}{8}$–$1\frac{1}{4}$ in. Fruit 3-12 in. long (rarely more), $\frac{3}{4}$–$1\frac{3}{4}$ in. diam., tapering; base flat or slightly depressed; flesh $\frac{1}{12}$–$\frac{1}{6}$ in. thick, sometimes mild, sometimes extremely pungent.

The varieties differ from *C. annuum acuminatum* by the stems and branches being larger and more stalky; leaves larger, often pendent and involute; calyx pateriform or funnel form; fruit larger, and flesh thicker.

+– Corolla more or less blotched with purple; fruit at first nearly black, afterwards becoming orange-red.

Black Nubian*. Plant vigorous, 2–$2\frac{1}{2}$ ft. high, quite loosely spreading 2–3 ft. Stem and branches smooth, dark purple or purple striate. Leaves 2–3 in. long, $1\frac{3}{8}$–$1\frac{5}{8}$

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* Childs, Cat. 1892.— *Purple* or *Sore-throat.* Titford, Hort. Bot. 47. 1812.— *Purple or Blue Podded* syn. *Black Podded.* Burr, Field & Gard. Veg. 623. 1863.— *Purple Capsicum.* Vilmorin-And. Veg. Gard. 151. 1885 [Eng. ed. Robinson].— French, *Piment violet, Piment noir.*— German, *Schwarzer nubischer Pfeffer.*

Capsicum nigrum Willd. Enum. Hort. Reg. Berol. **1**: 242. 1809.—Poiret, Enc. Meth. Suppl. **4**: 414. 1816.

Capsicum purpureum Vahl ex Hornem. Hort. Hafn. **1**: 224. 1813.— Roxb. Fl. Ind. **1**: 573. 24 Dec. 1831.— Don, Hist. Dich. Pl. **4**: 446. 1838.

Capsicum violaceum DC. Hort. Monsp. 87. 1813.— Kunth, Nov. Gen. Sp. Pl. **3**: 49. 1818.— Fingerh. Monogr. Gen. Capsici 23. 1832.— Don, Hist. Dich. Pl. **4**: 447. 1838.—Dunal in DC. Prodr. **13**[1]: 423. 1852.

Capsicum bicolor (Jacq.).—Bot. Mag. **43**. *t. 1835.* 1816.—Linn. Sp. Pl. **4**: 564. 1819 [ed. Röm. et Schult.].— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. Gen. Capsici 15. *t. 3. f. a.* 1832.— Don, Hist. Dich. Pl. **4**: 446. 1838.— Dunal in DC. Prodr. **13**[1]: 413. 1852.— Seemann, Bot. Herald 401. 1852–57.— Miquel, Fl. Ned. Ind. **2**: 660. 1856.

Capsicum Quitense Willd. Herb.— Linn. Syst. **4**: 809. 1819 [ed. Röm. et Schult.]. Fide Index Kewensis.

in. wide, more or less blotched with purple especially along the veins, smooth, slightly puffed; petiole $\frac{1}{2}$–$1\frac{1}{2}$ in. long. Peduncles straight or curved on same plant, $\frac{7}{8}$–$1\frac{1}{8}$ in. long, quite slender. Corolla spreading $\frac{3}{4}$–$\frac{7}{8}$ in., purple or purple striate along the margins of the petals. Ovary green at first but soon after the corolla drops becoming a dark glossy purple. Fruit upright, spreading, or pendent, on same plant, 2–4 in. long, $\frac{1}{2}$–$\frac{5}{8}$ in. diam., tapering to a rounded or sometimes acute apex, smooth or somewhat irregularly curved, 1–2 celled; base usually narrowing into the calyx; flesh about $\frac{1}{12}$ in. thick, quite firm, extremely pungent; black or dark purple, ripening into a deep orange-red mottled with dingy brown spots.

+ Corolla white.

++ Calyx pateriform, usually not entirely covering the flat base of the fruit.

Long Red.* Branches often quite prominently purple striate. Corolla spreading about $1\frac{1}{4}$ in. Fruit 4–7 in. long, $\frac{5}{8}$–$1\frac{1}{8}$ in. diam., oblong conical, frequently more or less curved, with an acute, rounded or sometimes obscurely 2–3 lobed apex, smooth, sometimes obscurely furrowed

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Capsicum bicolor purpureum Fingerh. Monogr. Gen. Capsici 16. 1832.— Dunal in DC. Prodr. **13**^{1}: 414. 1852.

Capsicum Hamiltonii Don, Hist. Dich. Pl. **4**: 447. 1838.— Dunal in DC. Prodr. **13**^{1}: 429. 1852.

Capsicum longum violaceum Dunal in DC. Prodr. **13**^{1}: 424. 1852.

Capsicum Narunca Hort. Matr. ex Dun. in DC. Prodr. **13**^{1}: 414. 1852. Fide Index Kewensis.

Capsicum siliquis longis, propendentibus, purpureis. Haller, Enum. Hort. Gott. 215. 1753.

* Burr, Field & Gard. Veg. 622. 1863.— Vilmorin-And. Veg. Gard. 150. 1885 [Eng. ed. Robinson].— Bailey, Bull. Mich. Agr. Col. 31: 39. 1887.— *Coral Peppers.* Titford, Hort. Bot. 1812.— French, *Piment rouge long, Piment rouge long ordinaire.*— German, *Langer rother Pfeffer.*

Capsicum longum DC. Cat. Monsp. 86. 1813.— Linn. Syst. **4**: 560. 1819 [ed. Röm et Schult.].— Hornem. Hort. Hafn. Suppl. 27. 1819.— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Miquel, Fl. Ind. **2**: 658. 1856; Mus. Lugd.-Bat. **3**: 117. 1867.

longitudinally, rarely subrugose, 2-celled; flesh $\frac{1}{16}$–$\frac{1}{12}$ in. thick, usually quite pungent, sometimes mild.

A very old and universally cultivated variety, especially in European countries. Dr. Palmer speaks of the Mexican plant corresponding to this variety as very common in cultivation in that country, being the universal market variety which bears abundantly. Several cases were seen where plants were in quite a thrifty condition at three years of age. These plants were four feet high, presenting a clumsy appearance, with heavy branches hanging loosely about. The fruit on a single plant was variable in shape, straight or bent, smooth or wrinkled, slender or thickened.

County Fair.* Fruit 4–6 in. long, $1\frac{1}{2}$–2 in. diam. at the base, hornshaped, smooth, glossy, rounded at apex, often with obscure furrows extending a part or the entire length, terminating in a minutely lobed apex; flesh firm, about $\frac{1}{8}$ in. thick or more, mild and slightly juicy when ripe, somewhat pungent about the seeds, deep red.

This is one of the most productive of the long varieties, as well as the best in quality, and merits a high place where pungent properties are not desired. It was introduced about 1892.— Plate 14, f. 1.

++ ++ Calyx funnel form, usually entirely covering the base or sometimes obscurely embracing the fruit.

Cardinal.† Plants not distinguishable from Long Red. Peduncles sometimes curved upwards, placing the fruit in an erect position. Fruit 4–7 in. long, $\frac{3}{4}$–$1\frac{1}{4}$ in. diam., taper-

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* Henderson, Cat. 1892.

Capsicum longum incrassatum Fingerh. Monogr. Gen. Capsici 24. *t.* 7. *f. a.* 1832.—Dunal in DC. Prodr. 13[1]: 424. 1852.

Capsicum Americanum, fructu oblongo, dulce (Plum.) Tournef. Inst. 153. 1700.

Solanum mordens fructu propendente oblongo crasso. Weinmann. Phyt. 349. *t.* 927. *f. c.* 1745.

† Henderson, Cat. 1891.— *Red Cardinal.* Bailey, Bull. Mich. Ag. Col. 31: 40. 1887.

ing to a usually acute apex, usually curved and sometimes twisted, often obscurely furrowed; flesh about $\frac{1}{12}$ in. thick, slightly pungent; seeds extremely pungent. Introduced about 1890.— Plate 13, f. 1.

Long Yellow.* Fruit averages a little smaller than Long Red, otherwise the same except in color, which is a bright yellow, and in the calyx which is somewhat funnel form entirely covering or slightly embracing the base of the fruit. A very old variety.— Plate 12, f. 2.

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* Burr, Field & Gard. Veg. 622. 1863.— Vilmorin-And. Veg. Gard. 151. 1885 [Eng. ed. Robinson].—*Long Yellow French.* Bailey, Bull. Mich. Agr. Col. 31: 38. 1887.— French, *Piment jaune long.*—German, *Langer gelber Pfeffer.*

Capsicum longum rectum Fingerh. Monogr. 25. *t. 7. f. c.*

Capsicum longum luteum Hort. Vilmorin-And. Fl. Pleine Terre 884. 1870 [3d ed.].

Piper Indicum propendentibus siliquis etc. diff. 3. Siliqua flava, vel aurea. Bauhin. Pinax 102. 1623.

Capsicum siliqua flava breviore. Parkinson, Theat. Bot. 357. *f. 18.* 1640.

Capsicum siliqua flava longiore. Parkinson, Theat. Bot. 358. 1640.

Piper longum siliquis luteis. Jonstonus, Dendrog. *t. 56.* 1662.

Piper siliqua flava. Jonstonus, Dendrog. *t. 56.* 1662.

Capsicum siliquis flavis. Magnol, Hort. Reg. Monsp. 42. 1697.

Capsicum sive Piper Indicum siliqua flava vel aurea oblonga. Morison, Hist. Pl. Oxon. 3: 530. 1699.

Capsicum sive Piper Indicum siliqua flava lata. Morison, Hist. Pl. Oxon. 3: 530. 1699.

Capsicum fructu flavescente. Tournef. Inst. 152. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.— Boerhaave, Index Pl. Lugd.-Bat. 2: 68. 1727.

Piper Indicum Aureum latum. Hort. Eyst. 1. Aut. Ord. 1: 9. *f. 2.* 1713.

Piper Indicum Siliquis flavis. Hort. Eyst. l. c. *f. 1.*

Capsicum; fructu flavo, pyramidato, oblongo, nunc erecto, nunc nutante. Miller, Gard. Dict. 1731 [no. 11].

Capsicum; siliqua lata; nervosa; longa; recurva lutea. Boerhaave, Index Pl. Lugd.-Bat. 2: 69. 1727.

Capsicum; siliqua propendente; aurea; incurva. Boerhaave, Index Pl. Lugd.-Bat. 2: 69. 1727.

Capsicum; siliquis recurvis; luteis. Boerhaave, Index Pl. Lugd.-Bat. 2: 68. 1727.

Solanum mordens fructu aureo lato. Weinmann. Phyto. 349. *t. 928. f. b.* 1745.

Solanum mordens siliquis flavis. Weinmann. Phyto. 349. *t. 928. f. c.* 1745.

++ ++ ++ Calyx usually seated in a basal depression.

ELEPHANT'S TRUNK.* Evidently a large form of Cardinal. Fruit 6–9 in. long, rarely about a foot, $2\frac{1}{2}$–$3\frac{1}{2}$ in. diam., deeply furrowed and wrinkled, tapering gradually from the base to a prominently 3–4 lobed apex, often much curved and twisted, dark red; flesh somewhat pungent. Introduced about 1892.— Plate 13, f. 2.

PROCOPP'S GIANT.† Fruit 5–8 in. long, $1\frac{3}{4}$–$2\frac{1}{2}$ in. diam. at base, very rugose and irregular in form; flesh quite thick (about $\frac{1}{8}$ in.), slightly pungent. Introduced about 1888.

Because of the many peculiar contortions it ordinarily assumes it is often considered a monstrosity.— Plate 14, f. 2, and plate 15, f. 1.

++ ++ ++ ++ Calyx usually cup-shaped and inclosing base of fruit.

IVORY TUSK.‡ Plant quite a rank grower. Peduncles slender. Fruit 3–6 in. long, $\frac{1}{2}$–$\frac{3}{4}$ in. diam., pendent, straight or slightly curved, usually smooth at first, the ripe fruit often with few shallow longitudinal furrows, the glossy surface of the unripe fruit resembling a tusk, often of an ivory white sometimes tinged with green, finally becoming a deep red; flesh medium thin, moderately pungent. Introduced in 1894, and not yet very generally disseminated.— Plate 11, f. 2.

a a Fruit oblate or oblong, truncated, deeply lobed, furrowed and wrinkled; flesh mild, $\frac{1}{12}$–$\frac{1}{8}$ in. thick.

C. annuum grossum Sendt.

Capsicum grossum Linn. Mant. 47. 1767.— Thunb. Fl. Jap. 93. 1784.— Linn. Syst. 226. 1784 [ed. 14. Murray].— Aiton, Hort. Kew. **1**: 254.

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* Benary, Seed Cat. 1895.— French, *Trompe d' éléphant.*— German, *Elephanten-Rüssel.*

Capsicum annuum proboscideum. Haage & Schmidt, Gartenflora **41**: 582, 583, *f. 125.* 1892.

† Benary, Seed Cat. 1894.— German, *Procopp's riesen Pfeffer.*

‡ Childs, Cat. 1894.

Capsicum ceratocarpum. Fingerh. Monogr. Gen. Capsici **22**. *t. 6. f. c.* 1832.— Dunal in DC. Prodr. **13**^{1}: 423. 1852.

1789.— Desfont. Fl. Atlant. **1**: 196. 1789–1800.— Linn. Sp. Pl. **1**: 1051. 1797 [ed. Willd.].– Miller, Gard. Dict. 1797 [ed. Martyn].— Lam. Enc. Meth. **2**: 26. 1793 [no. 2389].— Poiret, Enc. Meth. **5**: 326. 1804.— Persoon, Syn. Pl. **1**: 230. 1805.— Hornem. Hort. Hafn. **1**: 223. 1813.— Linn. Syst. **4**: 562. 1819 [ed. Röm. et Schult.].— Moon, Cat. Pl. Cey. 16. 1824.— Fingerh. Monogr. Gen. Capsici 21. *t. 5–6.* 1832.— Roxb. Fl. Ind. **1**: 574. 1832.— Nees von Esenb. Trans. Linn. Soc. **17**: 162. 1832.—Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 422. 1852.— Miquel, Fl. Ned. Ind. **2**: 659. 1856.— Hooker, Fl. Brit. Ind. **4**: 239. 1885.

Capsicum angulosum Miller, Gard. Dict. 1771 [no. 4. 6th ed.].— Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. Gen. Capsici 27. *t. 8. f. a.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 426. 1852.

Capsicum annuum angulosum Miller, Gard. Dict. 1797 [ed. Martyn].

Capsicum silvestre Vell. Fl. Flum. Repr. in Rio de Jan. Archiv. Mus. Nac. **5**: 58. 1881.

Capsicum annuum rugulosum Fingerh. Monogr. 13. *t. 2. f. b.* 1832.

Capsicum angulosum ovale Fingerh. Monogr. 28. *t. 8. f. b.* 1832.— Dunal in DC. Prodr. **13**[1]: 426. 1852.

Capsicum angulosum conicum Fingerh. Monogr. 28. 1832.— Dunal in DC. Prodr. **13**[1]: 426. 1852.

Capsicum grossum pomiferum Fingerh. Monogr. Gen. Capsici 22. *t. 5. f. c.* 1832.—Don, Hist. Dich. Pl. **4**: 446. 1838.— Dunal in DC. Prodr. **13**[1]: 423. 1852.

Capsicum grossum ovatum Fingerh. Monogr. Gen. Capsici 22. *t. 5. f. d.* 1832.— Dunal in DC. Prodr. **13**[1]: 423. 1852.

Capsicum grossum cordatum Fingerh. Monogr. Gen. Capsici 22. *t. 6. f. a.* 1832.— Nees von Esenb. Trans. Linn. Soc. **17**: 63. 1832.

Capsicum grossum angulosum Fingerh. Monogr. Gen. Capsici 22. *t. 6. f. b.* 1832.— Dunal in DC. Prodr. **13**[1]: 423. 1852.

Capsicum Chamaecerasus Nees von Esenb. Trans. Linn. Soc. **17**: 65. 1832.

Capsicum grossum globosum Don, Hist. Dich. Pl. **4**: 446. 1838.

Capsicum grossum bifidum Don, Hist. Dich. Pl. **4**: 446. 1838.

Capsicum pomiferum Steud. Nom. **1**: 279. 1840 [ed. 2].

Capsicum annuum grossum Sendt. in Martius, Fl. Bras. **10**: 147. 1846.— Kuntze, Revis. Gen. Plant. 449. 1891.

Capsicum annuum rugosum Dunal in DC. Prodr. **13**[1]: 412. 1852.

Capsicum angulosum macrocarpum Dunal in DC. Prodr. **13**[1]: 426. 1852.

Capsicum Axi (Blume). Vell. Fl. Flum. Repr. in Rio de Jan. Arch. Mus. Nac. **5**: 59. 1881.— Dunal in DC. Prodr. **13**[1]: 428. 1852.

Siliquastrum quartum. Fuch. Hist. Stirp. Basil. 734. *f.* 1542.

Capsicon latum. Fuch. Hist. Stirp. Basil. 427. *f.* 1545.

Siliquastrum latum. Fuch. Hist. Stirp. Lugd. 694. *f.* 1551.

Capsicum latum. Dodon. Post. Trium. Ant. 183. *f.* 1554.

Capsicum latis siliquis. Dodon. Hist. Stirp. Pempt. 705. *f.* 1583; 717. *f.* 1616.

Piperis Indici varietas. Matth. Opera 434. *f.* 1598; 434. *f.* 1674.

Piper cum siliqua lata ac rugosa. Greg. de Reg. in Clus. Cur. Post. 99–100. *f. 8.* 1611.—Jonstonus, Dendrog. *t. 56.* 1662.—Raius, Hist. Pl. **1**: 678. 1686.

Capsicum siliqua lata & rugosa. Parkinson, Theat. Bot. 357–358. *f. 3.* 1640.

Capsicum bifurcata siliqua. Parkinson, Theat. Bot. 358. 1640.

Capsicum siliqua latiore & rotundiore. Bauhin. Hist. Pl. **2**: 943. *f.* 1651.—Tournef. Inst. 152. 1700.—Boerhaave, Index. Pl. **2**: 69. 1727.—Miller, Gard. Dict. 1771 [ed. 6].

Piper Capsicum siliqua latiore & rotundiore. Chabraeus, Omn. Stirp. Sciag. 297. *f.* 1677.

Capsicum seu Piper Indicum siliqua longa ampliore & dulciore Mexicanum. Morison, Pl. Hist. Oxon. **3**: 529. 1699.

Capsicum sive Piper Indicum longum ventre tumido, siliqua per summum tetragona. Morison, Pl. Hist. Oxon. **3**: 529. 1699.

Capsicum sive Piper Indicum maximum obtusum. Morison, Pl. Hist. Oxon. **3**: 530. 1699.

Capsicum fructu longo, ventre tumido, per summum tetragono. Tournef. Inst. 152. 1700.

Capsicum fructu bifido. Tournef. Inst. 152. 1700.— Tillus, Cat. Pl. Pisa. 30. 1723.—Boerhaave, Index Pl. **2**: 69. 1727.

Capsicum fructu tereti, oblongo, latifolium. Tillus, Cat. Pl. Pisa. 30. 1723.

Capsicum; siliqua lata nervosa; rubra. Boerhaave, Index Pl. **2**: 69. 1727.

Capsicum; Africanum, fructu pyramidali pendulo rugosissimo. Miller, Gard. Dict. 1731 [no. 4].

Capsicum; fructu maximo, oblongo rugoso plerumque nutante rubro. Miller, Gard. Dict. 1731 [no. 18].

Solanum mordens bifurcata siliqua. Weinmann. Phyt. 349. *t. 928. f. a.* 1745.

Turbilo-Pepper, Hughes, Hist. Barb. 213. 1750. Fide Maycock, Fl. Barb. 104. 1830.

Plants herbaceous, 1½–2 ft. high. Branches green, often warty, glabrous, much enlarged at the nodes. Nodes slightly blotched with purple, subhairy. Leaves thick, dark green, often glossy on the upper surface, ovate, acuminate or sometimes obtuse; lower ones very large, usually 3–5 in. long, 2¼–3½ in. wide, usually pendent, more or less wrinkled, often slightly involute; veins prominent, rarely subpilose on the under surface; petioles 2–3 in. long, stout, deeply channeled: upper ones smaller, quite erect, rarely wrinkled or involute. Peduncles stout, ¾–1 in. long,

often swollen at the base, abruptly narrowing just above, gradually enlarging toward the calyx end. Corolla large, spreading $\frac{7}{8}$–$1\frac{1}{4}$ in., coarse, dingy white. Fruit large, oblate, oblong, or truncated, deeply 3–4 lobed, usually with a basal depression, more or less sulcate and rugose, 3–4 celled; flesh $\frac{1}{12}$–$\frac{1}{8}$ in. thick, firm, and of a mild flavor.

++ Fruit pendent, not usually oblate.

= Fruit subconical, usually tapering to a narrow obscurely lobed or sometimes rounded apex.

EMPEROR.* Plants about 2 ft. high, vigorous. Fruit 3–5 in. long, $1\frac{1}{2}$–$2\frac{1}{2}$ in. diam.,† tapering toward the apex, giving a broadly conical form, slightly furrowed; apex rounding or obscurely lobed; flesh medium thick, slightly pungent.

= = Fruit subconical or prismatic, slightly tapering to a 3 to 4 lobed apex, decidedly longer than broad.

MONSTROUS.‡ Plants 2–$2\frac{1}{2}$ ft. high, vigorous, much branched and with a dense foliage. Peduncles curved or rarely straight. Fruit 3–6 in. long, $1\frac{1}{2}$–$2\frac{1}{2}$ in. diam., cylindro-conical, 3–5 shallow furrows extending the entire length, often transversely sulcate and very rugose, 3–5 lobed, 2–3 celled; flesh $\frac{1}{8}$ in. thick, slightly pungent, dark red. A late but prolific variety, originated in France and introduced to notice in this country about 1867. — Plate 16.

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* *Giant Emperor.* Thorburn, Cat. 1883.— Bailey, Bull. Mich. Agr. Col. 31: 40. 1887.

† Henderson, Cat. 1883, and Thorburn, Cat. 1884, give the size of the fruit as 3 by $1\frac{1}{4}$ in., which is evidently a mistake.

‡ Vilmorin-And. Veg. Gard. 153. 1885 [Eng. ed. Robinson].— *Monstrous*, or *Grossum.* Henderson, Cat. 1876.— *Spanish Monstrous.* Thorburn, Cat. 1884.— *Monstrosum.* Burr, Cat. 1886.— *Crimson Queen.* Tillinghast, Cat. according to Dr. Sturtevant.— French, *Piment monstrueux.*— German, *Sehr grosser milder monströser Pfeffer.*

Capsicum grossum monstrosum Hort. Vilmorin-And. Fl. Pleine Terre 884. 1870 [3d ed.].

SWEET SPANISH.* Evidently only a form of Monstrous. Fruit 4–6 in. long, 2–3 in. diam., but slightly tapering toward the apex, usually with three or four furrows extending from the base to the apex, giving a uniformly prismatic shape with rounded angles.— Plate 17.

YELLOW SPANISH.† Identical with the preceding except that the fruit is of a bright yellow color.

= = = Fruit squarish, subtruncate, slightly longer than broad, sometimes very oblate; apical end often much contorted.

BELL.‡ Plant like the Monstrous. Fruit 2–3 in. long, $1\frac{1}{2}$–$2\frac{3}{4}$ in. diam., subtruncate, 3–4 prominent furrows extending the entire length, often with one or more secondary furrows between the prominent ones near the base which vanish toward the apex, often lobed about a central nipple and sometimes much contorted at the apex, 3–4 celled; flesh $\frac{1}{8}$–$\frac{1}{6}$ in. thick, slightly pungent. The fruit appears exceptionally subject to great variation, and very oblate forms often appear which are almost identical with the Squash pepper. Professor Bailey§ has recorded a variation toward the Cayenne type. The oblate form of Bell may usually be recognized by a slight projection at the apical end, while in the Squash variety this character is usually wanting.— Plate 18, and plate 19, f. 1.

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* Burr, Field and Gard. Veg. 625. 1863.— *Quince-Pepper.* Burr, l. c. 623.— *Large Sweet Spanish.* Landreth, Cat. 1881.— *Spanish Mammoth.* Vilmorin-And. Veg. Gard. 153. 1885 [Eng. ed. Robinson].— *New Sweet Spanish.* Henderson, Cat. 1887.— French, *Piment doux d'Espagne.*— German, *Rother milder spanischer Pfeffer.*

† This name is given to the yellow form of *Spanish Mammoth*, according to Vilmorin-And. Veg. Gard. l. c.

‡ Burr, Field & Gard. Veg. 617. 1863.— *Red Prince.* Everitt, Cat. 1887.— *Bell*, or *Bull Nose.* Hend. Gard. for Profit 264. 1887 [3d ed.].— *Sweet Spanish.* Bailey, Bull. Mich. Agr. Col. 31: 41. 1887.— *Bull Nose.* Landreth, Cat. 1894.—French, *Piment gros carré doux, Piment cloche.*

§ Bull, Mich. Agr. Col. 31: 37. 1887.

≡≡ Fruit squarish, subtruncate, slightly longer than broad, neither oblate nor with apex contorted.

SWEET MOUNTAIN.* Plants $1\frac{1}{4}-2$ ft. high. Branches comparatively few. Fruit 3–4 in. long, 2–3 in. diam., not tapering toward the apex, 3–4 shallow furrows extending the entire length, usually uniformly 3-lobed; flesh mild. Originated about 1865.

This variety is sometimes considered a synonym of Bell but the uniformly smaller plants and larger and milder fruits, which are not as subject to great variation, make it quite distinct, though at most it is but a subvariety or improved form.— Plate 19, f. 2, and plate 20.

GOLDEN DAWN.† Not usually distinguishable from the last except that the fruit is of a beautiful golden yellow color. It often varies to subconical without increasing in length. Introduced about 1882.— Plate 21, f. 2.

≡≡═ Fruit squarish, subtruncate, longer than broad, usually slightly tapering.

RUBY KING.‡ Plant not distinguishable from Sweet Mountain. Fruit 4–7 in. long, 2–4 in. diam., deeply 4–5 furrowed and lobed, usually slightly tapering toward the apex; flesh slightly pungent. A very large form of Bell. Introduced about 1884.— Plate 21, f. 1.

GOLDEN KING § is said to have originated as a sport

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* Burr, Field & Gard. Veg. 625. 1863.— Bailey, Bull. Mich. Agr. Col. 31: 41. 1887.— *Sweet Mountain*, or *Mammoth*. Hend. Gard. for Profit 264. 1886.—French, *Piment carré doux d'Amérique*.—German, *Eckiger dicker kurzer rother süsser Pfeffer*.

† Thorburn, Cat. 1883.— Hend. Gard. for Profit 265. 1886 [3d ed.].— *Golden Dawn Mango*. Sibley, Cat. 1884.— *Yellow Bell*. Bailey, Bull. Mich. Agr. Col. 31: 41. 1887.— *Yellow Nocre*. Notes and figures by Dr. Sturtevant, seed from Batchelor, 1887.— *Sweet Golden Dawn*. Thorburn, Cat. 1887.— *Golden Mango*. Seed from Childs, 1892.— French, *Piment carré jaune hatif*.

‡ Hend. Gard. for Profit 265. 1886 [3d ed.].— *New Large Scarlet*. Batchelor, seed, 1887.

§ Burpee, Cat. 1894.— *Mammoth Golden Queen*. Storrs & Harrison, Cat. 1882.— *Orange Mammoth*. Livingston, seed, 1887.— French, *Piment mammoth jaune d'or*.

from Ruby King about 1886. The fruit appears to be a little shorter in proportion to the diameter than Ruby King, otherwise the same except that the color is a bright golden yellow. Introduced about 1893.— Plate 22, f. 1.

++ ++ Fruit erect, not usually oblate.

Brazilian Upright.* Plant about 2 ft. high, foliage rather dense. Leaves 3–5 in. long, ovate acuminate to ovate obtuse. Penduncles 1–1¼ in. long, comparatively slender, sometimes slightly bent under weight of fruit. Fruit 2–5 in. long, 1½–2½ in. diam., prismatic, subconic or subtruncate, irregularly rugose, rarely nearly smooth, in general 2–3 lobed at apex, 2–3 deep furrows at base becoming obscure or lost at the middle; base usually depressed; flesh firm, about ⅛ in. thick, mild; seeds acrid. Introduced about 1890.— Plate 23.

Golden Upright.† About 1½ ft. high, with few large stout branches. Leaves dark green, few. Fruit yellow, 3–4 in. long, 2–3 in. diam., subtruncate, deeply 3–4 lobed, flat or slightly depressed at base, 3–4 shallow sinuses radiating from the calyx, vanishing toward the middle, reappearing

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* *New Brazilian Sweet Upright.* Thorburn, Cat. 1892.

Piper rotundum majus surrectum. Greg. de Reg. in Clus. Cur. Post. 96-97. *f. 1.* 1611.— Raius, Hist. Pl. **1**: 677. 1686.

Piper Indicum siliquis surrectis rotundis, diff. 1. maximum obtusum. Bauhin. Pinax 103. 1623.

Piper Indicum siliquis surrectis & oblongis. diff. 4. siliqua bifurcata. Bauhin. Pinax 103. 1623.

Capsicum rotundum majus surrectum. Parkinson, Theat. Bot. 356-357. *f. 3.* 1640.

Capsicum sive Piper Indicum siliqua bifurcata. Morison, Pl. Hist. Oxon. **3**: 530. 1699.

Piper Indicum bifurcata siliqua. Hort. Eyst. **1.** Autum. Ord. 1: 8. *f. 2.* 1713.

Piper Indicum maximum rotundum erectum. Hort. Eyst. **1.** Autum. Ord. 1: 11. *f. 1.* 1713.

Capsicum Africanum; fructu pyramidale rugosissimo plerumque erecto. Miller, Gard. Dict. 1731 [no. 5].

† Burpee, Cat. 1883.— *Golden Upright Sweet Mango.* Benary, Cat. 1893–4.— *Yellow Nocre.* Benary, Cat. 1893–4.

and becoming deeper toward apex, usually 1–2 obscure sinuses between larger ones, subrugose, 3–4 celled; flesh firm and sweet; seeds slightly acrid. The fruit has a tendency to elongate, becoming subconical, often nippled at the apex and sometimes obscurely furrowed. Introduced 1887.— Plate 22, f. 2.

++ ++ ++ Fruit pendent, very oblate.

SQUASH.* Plant 1–2 ft. high with few stout, quite erect branches. Peduncles 1–1½ in. long, stout, much enlarged toward calyx end. Fruit truncate, very oblate, 1–2 in. long, 2–3 in. diam., usually with three or more deep furrows extending from base to or near the apex and numerous obscure ones about half as long, 2–3 celled; flesh firm, ⅛–¼ in. thick, rather insipid, slightly pungent, often with a trace of tomato flavor. This is a very late variety and not an abundant bearer. The fruit is excellent for mangoes.— Plate 24, and plate 25, f. 1.

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* Burr, Field & Gard. 624. 1863.— Bailey, Bull. Mich. Agr. Col. 31: 41. 1887.—*Red Tomato Capsicum* or *American Bonnet Pepper.* Vilmorin-And. Veg. Gard. 154. 1885 [Eng. ed. Robinson].— *Squash* or *Tomato-Shaped.* Hend. Gard. for Profit 265. 1886 [3d ed.].— *Red Tomato.* Bailey, Bull. Mich. Agr. Col. 31: 41. 1887.— *New Dwarf Early Red Squash.* Burpee, Cat. 1893.— French, *Piment tomate, Piment tomate nain hatif.*— German, *Liebesapfelfrüchtiger rother Pfeffer.*

Capsicum tetragonum Miller, Gard. Dict. 1771 [no. 3. ed. 6].— Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. Gen. Capsici 30. *t. 10. f. d.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Miquel, Fl. Ned. Ind. **2**: 658. 1856.

Capsicum annuum tetragonum Miller, Gard. Dict. 1797 [ed. Martyn].

Capsicum cydoniaeforme Hort. Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].

Capsicum tomatiforme Fingerh. in Steud. Nom. 279. 1840 [2d ed.].

Capsicum dulce Hort. Dunal in DC. Prodr. **13**[1]: 428. 1852.

Capsicum grossum lycopersicoides Vilmorin-And. Fl. Pleine Terre 884. 1870 [3d ed.].

Piper Indicum fructu dependente Pomi amoris forma. Bauhin. Pinax 102. 1623.— Raius, Hist. Pl. **1**: 678. 1686.

Solanum mordens seu Capsicum latifolium mali Aethiopici, etc. Plukenetius, Phyto. **1**. *t. 227. f. 1.* 1692.

YELLOW SQUASH.* Identical with the preceding except that the fruit is of a bright yellow color.

a a a Fruit subconical, ovate or elliptical, slightly longer than broad, ¾–2 in. long; calyx not embracing base.

C. annuum abbreviatum Fingerh.

Capsicum annuum abbreviatum Fingerh. Monogr. 14. *t. 2. f. 1.*

Plants suffrutescent, 1–2 ft. high. Branches numerous, erect or in some varieties loosely spreading, deep green, smooth, slender, distinctly angled, sometimes sulcate. Leaves broadly ovate, 2–4 in. long, 1¼–2¾ in. wide, minutely ciliate, usually deep green above, much paler below, extending slightly into the petiole, often puffed, sometimes smooth and glossy. Peduncles 1–1½ in. long, about as long as or longer than the fruit, rarely in twos, medium slender, straight or curved in different varieties, smooth, or on younger specimens subhairy. Calyx seated on the base of the fruit. Corolla medium, spreading about ¾ in., dingy white. Fruit ¾–2 in. long, varying much with different varieties, in general ovate, usually more or less rugose except in the Etna variety, sometimes turbinate, red or yellow when ripe, often variously blotched with brown or light yellow before ripening.

Capsicum sive Piper Indicum latifolium Mali Aethiopici fructu magnostriato. Morison, Hist. Pl. Oxon. 3: 529. 1699.

Capsicum seu Piper Indicum Pomi amoris forma. Morison, Hist. Pl. Oxon. 3: 529. 1699.

Capsicum fructu rotundo, maximo. Tournef. 153. 1700.— Tillus, Pisa. 30. 1723.

Piper Indicum rotundum maximum. Hort. Eyst. 1. Autum. Ord. 1: 10. *f. 1.* 1713.

Capsicum; latifolium; Mali Aethiopici etc. Boerhaave, Index Pl. Lugd.-Bat. 2: 69. 1727.

Solanum seu Piper Indicum maximum. Weinmann. Phyt. 4: 349. *t. 928. f. d.* 1745.

* Burr, Field & Gard. Veg. 626. 1863.—French, *Piment tomate jaune.*—German, *Liebesapfelfrüchtiger gelber Pfeffer.*

Capsicum grossum lycopersicoides luteum Hort. Vilmorin-And. Fl. Pleine Terre 884. 1870 [3d ed.].

* Fruit erect.

+– Light yellow or straw-color before ripening.

CELESTIAL.* Plants very erect, about 1½ ft. high, conical in form, rather compact, moderately branchy. Leaves rather lighter green and smaller than in other varieties of this group; petioles slender. Peduncles 1–1¼ in. long, straight, slender, stout, scarcely enlarging toward the calyx end. Fruit erect, 1¼–2½ in. long, 1–1¼ in. diam., ovate, subconical, or subpyramidal, rarely much elongated, smooth, or obscurely wrinkled; apex acute, rounded, or sometimes obscurely lobed; base flat, usually not entirely covered by the calyx; unripe of a greenish yellow or dingy white often with numerous purplish brown spots, later becoming more yellow or straw color, finally a bright red, 2–3 celled; flesh moderately firm, ⅛–¼ in. thick, extremely pungent. Introduced about 1887, having been brought from China some years before.

The fruit begins setting early, lasting nearly all summer. The lower ones ripening one or two weeks earlier than the others and borne, as most of them are, in large numbers beyond the leaves, the various colors on the same plant present an unusually novel appearance, making it especially desirable as a pot plant.—Plate 25, f. 2 and plate 26, f. 1.

+– +– Neither light yellow, nor straw-color.

ETNA.† Plants about 1½ ft. high. Branches numerous, quite diffusely spreading. Leaves medium, 1½–3

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* Thorburn, Cat. 1888.— *Childs' Improved Celestial.* Childs, Cat. 1894.— French, *Piment chinois.*

Capsicum leucocarpum Dunal in DC. Prodr. 13¹: 429. 1852.

Capsicum; Americanum, latifolium, fructu oblongo, erecto, candido. Miller, Gard. Dict. 1731 [no. 17].— Fingerh. Monogr. 32. 1832.

† *Red Etna.* Burpee, Cat. 1893.

Piper oblongum erectum majus pyramidale. Greg. de Reg. in Clus. Cur. Post. 97–98. *f. 2.* 1611.— Raius, Hist. Pl. 1: 677. 1686.

Piper erectum minus pyramidale. Greg. de Reg. in Clus. Cur. Post. 97–98. *f. 3.* 1611.— Raius, Hist. Pl. 1: 677. 1686.

in. long, 1–1¾ in. wide. Fruit 1–2 in. long, ⅝–1¾ in. diam., at first ovate or subconical, often becoming subtruncate and obscurely 2, 3, or rarely 4 lobed with the same number of shallow furrows, dark red; flesh about 1½ in. thick, slightly pungent. Only moderately productive. Introduced in 1890.— Plate 27, f. 2.

* * Fruit pendent.

+– Changing from green to light yellow or straw-color before ripening.

KALEIDOSCOPE.* Plants vigorous, about 2 ft. high, spreading 2½–3 ft. Branches long, slender, loosely spreading. Leaves medium large for the group, often smooth, glossy, and thick; petioles sometimes longer than the blade. Peduncles slender, obscurely canaliculate, curved. Fruit nodding or pendent, 1–1¼ in. long, ¾–1 in. diam., oval or elliptical, abruptly narrowing toward both ends, usually mucronate, often with a rigid bristly projection at the apex, subrugose, numerous shallow furrows extending a part or the entire length, changing in color from green to yellowish green, and yellowish red, finally a bright red; flesh about ⅛ in. thick, moderately firm, mild. Introduced 1890. Valuable mainly as an ornamental.— Plate 25, f. 3, and plate 26, f. 2.

Capsicum erectum pyramidale majus. Parkinson, Theat. Bot. 356. *f.* 1640.

Capsicum erectum pyramidale minus. Parkinson, Theat. Bot. 357. *f.* 1640.

* Childs, Cat. 1891.— German, *Kaleidoscop.*

Piper Indicum fructu aculeato. Bauhin. Pinax 102. 1623.— Raius, Hist. Pl. 1: 678. 1686.

Capsicum sive Piper Indicum fructu aculeato majus. Morison, Hist. Pl. Oxon. 3: 529. 1699.

Solanum urens fructu aculeato. Morison, Hist. Pl. Oxon. Sect. 13. *t.* 2. *f.* 16. 1699.

Capsicum fructu aculeato, minori. Tournef. Inst. 153. 1700.— Tillus. Cat. Pl. Pisa. 30. 1723.

Capsicum fructu aculeato, majori. Tournef. l. c.

Piper Indicum rotundum aculeatum. Hort. Eyst. 1. Aut. Ord. 1: 12 *f.* 1. 1713.

Piper Indicum orbiculatum medium. Hort. Eyst. l. c. *f.* 2.

+– +– Not changing from green to light yellow.
++ Usually more or less turbinate.

RED WRINKLED.* Plants 1–2 ft. high, often spreading 2–3 ft. Branches often purple striate. Leaves 2–3½ in. long, 1¼–2 in. wide; petioles 1–1¼ in. long. Peduncles curved, usually ⅞–1 in. long, slender, slightly enlarged toward calyx end. Corolla greenish white, spreading ½–¾ in. Fruit very rugose, about 1 in. long, ¾–⅞ in. diam., pendent or nodding, usually turbinate, with projecting nipples, bright red when ripe.— Plate 27, f. 3.

YELLOW WRINKLED.† Identical with the preceding except that the fruit is of a bright yellow color.

++ ++ Not usually turbinate.

PRINCESS OF WALES.‡— Plants 1–1½ ft. high, quite erect, branches numerous, slender, stiff, puberulent, scarcely more hairy at the nodes, leaves often puffed or wrinkled, 2–3½ in. long, 1½–2 in. wide, pubescent on veins below, ciliate; petioles medium short. Peduncles usually curved, slender, smooth. Corolla greenish white, usually spreading about ¾ in. Fruit conical to ovate-elliptical, 1–1¾ in. long, ¾–1 in. diam., more or less sulcate, rarely turbinate, at first dark green, becoming blotched with purple, finally

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* *Thorburn's Fancy Red Wrinkled.* Thorburn, Cat. 1892— German, *Runzliger rother Pfeffer.*

Capsicum umbilicatum Vell. Fl. Flum. Repr. in Rio de Jan. Arch. Mus. Nac. **5**: 60. 1881.— Dunal in DC. Prodr. **13**[1]: 428. 1852.— Sturt. Bull. Torr. Bot. Club **15**: 108. 1888.

† Thorburn, Cat. 1892.— German, *Runzliger gelber Pfeffer.*

‡ Williams, Cat. 1878.

Capsicum luteum Lam. Enc. Meth. **2**: 26. 1793 [no. 2392].— Poiret, Enc. Meth. **5**: 327. 1804.— Linn. Syst. **4**: 462. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. 26. *t. 8. f. c.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 425. 1852.

Piper siliqua flava. Greg. de Reg. in Clus. Cur. Post. 102. *f. 12.* 1611.— Raius, Hist. Pl. **1**: 678. 1686.

Solanum mordens seu Capsicum fructu flavescente. Weinmann. 349. *t. 930. f. a.* 1745.

a lemon yellow, usually 4-celled, extremely pungent. An ornamental English variety which originated about 1876 and is said to be the result of a cross between Prince of Wales and Yellow Gem, possessing the habit of the former and fruit of the latter. Not very generally catalogued by American seedsmen.

a a a a Fruit generally smooth, oval, spherical, cherry or heart shaped, ⅜–1½ in. in diameter; calyx seated on the base.

C. annuum cerasiforme (Miller).

Capsicum Olivaeforme Miller, Gard. Dict. 1771 [no. 6. ed. 6].

Capsicum ovatum DC. Cat. Hort. Monsp. 86. 1813.— Poiret, Enc. Meth. Suppl. **4**: 414. 1816.— Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. 28. *t. 9. f. b.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 426. 1852.

Capsicum oxycarpum Dunal in DC. Prodr. **13**[1]: 426. 1852.

Piper cum siliqua olivaria. Greg. de Reg. in Clus. Cur. Post. 99–100. *f. 6.* 1611.— Jonstonus, Dendrog. *t. 56.* 1662.— Raius, Hist. Pl. Oxon. **1**: 677. 1686.

Piper Indicum propendentibus siliquis rotundis, diff. 3. siliqua olivari. Bauhin. Pinax 102. 1623.

Capsicum siliqua Olivaria propendens. Parkinson, Theat. Bot. 357. *f. 10.* 1640.— Morison, Hist. Pl. Oxon. **3**: 529. 1640.

Capsicum siliqua Olivaria erecta. Parkinson, Theat. Bot. 357. 1640.

Solanum urens siliqua propendente, etc. Morison, Hist. Pl. Oxon. Sect. 13. *t. 2. f. 12.* 1699.

Capsicum sive Piper Indicum perenne siliqua Olivae magnitudine & forma. Morison, Hist. Pl. Oxon. **3**: 530. 1699.

Capsicum siliqua Olivae forma. Tournef. Inst. 153. 1700.

Capsicum; fructu Olivario erecto. Miller, Gard. Dict. 1731 [no. 13].

Plants suffrutescent, 1–2 ft. high, spreading 2–2½ ft., with rather dense foliage. Branches numerous, quite uniformly 4-angled, green or purplish striate, purple and much enlarged at nodes. Leaves ovate or oblong acuminate, 1¼–3½ in. long, ½–1½ in. wide, flat, usually slightly wrinkled, margins usually subciliate; petioles medium slender, ½–1 in. long. Peduncles curved or straight on different plants or often on the same plant, ⅜–½ in. long, stout, much enlarged toward calyx end, solitary, sometimes in twos. Calyx somewhat wrinkled, seated on base of fruit. Corolla large, dingy white, spreading ⅞–1⅛ in. Fruit spherical, subcordate,

oblate, or occasionally obscurely pointed or slightly elongated, erect, spreading, or pendent, ½–1 in. diam., smooth or very rarely minutely rugose or sulcate, when unripe often more or less blotched with purple on side next the sun; flesh firm, $\frac{1}{12}$–⅛ in. thick, extremely pungent.

* Fruit ⅜–½ in. in diameter, oval or lemon-shaped.

Little Gem.* Plant about 1½ ft. high. Leaves medium small, larger ones 2 in. long by 1 in. wide; petioles rather short. Peduncles straight or slightly curved. Corolla obscurely greenish white, spreading about ⅝ in. Fruit globular, ovate, or elliptical, about ⅜ in. diam., usually erect, smooth, red, usually 3-celled, extremely pungent. Introduced in England about 1881. Not generally catalogued by American seedsmen.

Prince of Wales.† Plant stout, upright-spreading, 12–15 in. high. Leaves 2–2½ in. long, 1–1½ in. wide. Peduncles curved, long and slender. Fruit small, about ½ in. diam., lemon-shaped, bright yellow. A very old and prolific variety formerly much cultivated in Europe as an ornamental plant.

* * Fruit ½–1 in. in diameter, generally cherry-shaped.

Cherry.‡ Plant 2–2½ ft. high, quite woody and very branchy. Fruit ¾–1 in. diam. quite uniformly spherical or cherry-shaped, smooth, sometimes obscurely furrowed; flesh firm, about ⅛ in. thick, extremely pungent, dark red.

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* Floral Magazine *pl. 479.* 1881.— *Williams' Little Gem.* Williams, Cat. 1882.— *Miniature Tom Thumb.* Batchelor, seed, 1887.—*Creole or Bird's Eye.* Thorburn, Cat. 1893.

† Veitch, Cat. 1872.— German, *Prinz von Wales Pfeffer.*

Capsicum sive Piper Indicum siliqua flava ovali. Morison, Hist. Pl. 3: 530. 1699.

‡ Burr, Field and Gard. Veg. 620. 1863.— Vilmorin-And. Veg. Gard. 152. 1885 [Eng. ed. Robinson].— *Round* or *Large Cherry-Pepper.* Burr, l. c. 624.— *Cranberry.* Hend. Gard for Profit 265. 1886.— Bailey, Bull, Mich. Agr. Col. 31: 37. 1887.— *Red French.* Bailey, l. c. 38. *Piment*

Although a well-fixed variety, elongated and very oblate forms of the fruit occasionally appear, especially from seed received under the name Cranberry.— Plate 28, f. 2 and 4.

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airelle rouge. Vilmorin-And. Cat. 1891.— French, *Piment cerise.*— German, *Kirschförmiger rother Pfeffer.*

Capsicum cerasiforme Miller, Gard. Dict. 1771 [no. 5. ed. 6].—Lam. Enc. Meth. **2**: 26. 1793 [no. 2391].— Linn. Sp. Pl. **1**: 1051. 1797 [ed. Willd.].— Poiret, Enc. Meth. **5**: 325. 1804.— Persoon, Syn. Pl. **1**: 230. 1805.— Aiton, Hort. Kew. **1**: 406. 1810.— Hornem. Hort. Hafn. **1**: 223. 1813.— Linn. Syst. **4**: 563. 1819 [ed. Röm. et Schult.].— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Roxb. Fl. Ind. **1**: 574. 1832.— Fingerh. Monogr. 19. *t. 5. f. b.* 1832.—Don, Hist. Dich. Pl. **4**: 446. 1838.— Dunal in DC. Prodr. **13**[1]: 422. 1852.—Miquel, Fl Ned. Ind. **2**: 660. 1856.

Capsicum annuum β Aiton, Hort. Kew. **1**: 253. 1789.

Capsicum annuum Miller, Gard. Dict. 1797 [ed. Martyn]. (In part.)

Capsicum sphaericum Willd. Enum. Hort. Berol. **1**: 241. 1809.— Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].— Hornem. Hort. Hafn. Suppl. 27. 1819.— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. 28. *t. 9. f. a.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 427. 1852.

Capsicum Milleri Linn. Syst. **4**: 563. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. 20. 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 422. 1852.

Capsicum cerasiflorum Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.

Capsicum cerasiforme minus Fingerh. Monogr. 20. 1832.—Dunal in DC. Prodr. **13**[1]: 422. 1852.

Capsicum cerasiforme maurocarpum Dunal, l. c.

Capsicum cerasiforme cerasiflorum Dunal, l. c.

Capsicum grossum cerasiformis Hooker, Fl. Brit. Ind. **4**: 239. 1885.

Siliquastrum variatas rotundum. Camer. Pl. Epit. 348. *f.** 1586.

Capsicum siliquis rotundis cerasi forma. Bauhin. Phytopinax 156. 1596.

Piper cum siliqua rotunda cerasorum modo. Greg. de Reg. in Clus. Cur. Post. 99–100. *f. 7.* 1611.— Jonstonus, Dendrog. *t. 56.* 1662.— Raius, Hist. Pl. **1**: 677. 1686.

Piper Indicũ siliquis surrectis rotundis. diff. 2. Rotundum minus parum acuminatum. Bauhin. Pinax 103. 1623.

Piper Indicum propendentibus siliquis rotundis. diff. 4. Siliqua rotunda. Cerasorum modo. Bauhin. Pinax 102. 1623.

Piper Indicum siliquis surrectis cerasi forma. Bauhin. Pinax 103. 1623.— Raius, Hist. 678. 1686.

Capsicum rotundioribus siliquis. Gerarde, Herball 364–365. *f. 7.* 1636.

Capsicum siliqua rotunda Cerasorum. Parkinson, Theat. Bot. 357–358. *f. 11.* 1640.

YELLOW CHERRY.† Identical with the preceding except that the fruit is of a yellow color. Not universally catalogued by seedsmen.— Plate 28, f. 2.

Piper rotundum majus surrectum. Jonstonus, Dendrog. *t. 56.* 1662.
Capsicum arborescens, fructu cerasino. Munting, Waare Oeffen. Pl. 342. 1682.
Capsicum frutescens, fructu cerasino. Munting, Warre Oeffen. Pl. 341. 1682.
Capsicum siliquis surrectis Cerasi forma. Magnol, Hort. Reg. Monsp. 42. 1697.
Capsicum sive Piper Indicum propendentibus siliquis rotundis. Morison, Hist. Pl. Oxon. 3: 529. 1699.
Capsicum sive Piper Indicum siliquis Cerasi forma. Morison, Hist. Pl. Oxon. 3: 530. 1699.
Capsicum sive Piper Indicum siliqua rotunda Cerasorum forma. Morison, Hist. Pl. Oxon. 3: 529. 1690.
Solanum urens siliqua propendente rotunda, etc. Morison, l. c. Sect. 13. *t. 2. f.* 14.
Solanum Capsicum dictum, propendentibus siliquis rotundis. Hermann. Hort. Acad. Lugd.-Bat. 576. 1687.
Capsicum siliquis surrectis, Cerasi forma. Tournef. Inst. 153. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.
Capsicum siliqua propendente, Cerasi forma. Tournef. Inst. 153. 1700.— Tillus, Cat. Pl. Hort. Pisa. 20. 1723.
Capsicum siliquis surrectis, rotundis. Tournef. 153. 1700.—Miller, Gard. Dict. 1771 [6th ed.].
Capsicum siliquis surrectis, rotundis, parum acuminatis. Tournef. Inst. 153. 1700.
Capsicum fructu rotundo, maximo. Tournef. Inst. 153. 1700. (In part.).—Tillus, Cat. Pl. Hort. Pisa. 30. 1723.—Miller, Gard. Dict. 1771 [6th ed.].
Capsicum; Americanum, fructu rotundo, Cerasorum forma. Miller, Gard. Dict. 1731 [no. 16].
Capsicum; fructu rotundo, majore, nunc erecto, nunc nutante rubro. Miller, Gard. Dict. 1731 [no. 10].
Solanum Capsicum fructu erecto rubro rotundo. Weinmann. Phyt. 349. *t. 929. f. a.* 1745.
Solanum mordens fructu rotundo. Weinmann. Phyt. 349. *t. 928. f. f.* 1745.

† *Yellow Fruited Cherry Pepper.*— Burr, Field and Gard. Veg. 621. 1863.— French, *Piment cerise jaune.*— German, *Kirschförmiger gelber Pfeffer.*

Capsicum cerasiforme luteum Hort. Vilmorin-And. Fl. Pleine Terre 885. 1870 [3d ed.].

* * * Fruit 1–1½ in. in diameter, usually heart-shaped.

Oxheart.* Plant 1–2½ ft. high. Branches few, stout, quite erect. Fruit usually heart-shaped, sometimes oblate,

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* Bailey, Bull. Mich. Agr. Col. 31: 38. 1887.

Capsicum cordiforme Miller, Gard. Dict. 1771 [no. 2. 6th ed.].— Linn. Syst. **4**: 561. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. 29. *t.* 9. *f. c.* 1832.— Don, Hist. Dich. Pl. **4**: 445. 1838.— Dunal in DC. Prodr. **13**[1]: 427. 1852.—Miquel, Fl. Ned. Ind. **2**: 658. 1856.— Reichenb. Ic. Fl. Germ. **20**. *pl. 13. f. 3.* 1862.—Miquel, Mus. Lugd.-Bat. **3**: 117. 1867.

Capsicum cordiforme majus Fingerh. l. c.— Dunal, l. c.

Capsicum cordiforme minus Fingerh. l. c.— Dunal, l. c.

Capsicum cordiforme subangulosum Fingerh. l. c.— Dunal, l. c.

Capsicum cordiforme olivaeforme Fingerh. l. c.— Dunal, l. c.

Capsicum annuum cordiforme Sendt. in Martius, Fl. Bras. **10**: 148. 1846.

Capsicum cordiforme cerasicarpum.— Dunal, l. c.

Siliquastrum Cordatum. Camer. Pl. Epit. 348. *f. t.* 1586.

Capsicum siliquis latis cordatis. Bauhin. Phytopinax 156. 1596.

Piperis indici varitas. Matth. Opera 434. *f.* 1598.

Piper cordatum. Greg. de Reg. in Clus. Cur. Post. 99. *f. 5.* 1611.— Raius, Hist. Pl. **1**: 677. 1686.

Piper Indicũ siliquis surrectis rotundis. diff. 3. cordatũ majus, diff. 4. cordat. min. angulosũ. Bauhin. Pinax 103. 1623.

Piper Indicum propendentibus siliquis rotundis. diff. 2. siliqua cordata. Bauhin. Pinax 102. 1623.

Capsicum cordatum erectum majus, ditto, minus. Parkinson, Theat. Bot. 357. 1640.

Capsicum cordatum propendens. Parkinson, Theat. Bot. 357. *f. 9.* 1640.— Sloane, Hist. Jam. 114. 1696.

Figure without name. Hernandez, Novae Hist. Romae. 136. 1651.

Piper cordatum. Jonstonus, Dendrog. *t. 56.* 1662.

Piper Cordatum surrectum majus, ditto, minus. Jonstonus, Dendrog. *t. 56.* 1662.

Piper rotundum majus surrectum. Raius, Hist. Pl. **1**: 677. 1686. (In part.)

Capsicum cordatum siliqua surrecta. Magnol, Hort. Reg. Monsp. 42. 1697.

Capsicum sive Piper Indicum cordatum, majus & minus. Morison, Hist. Pl. **3**: 530. 1699.

Capsicum seu Piper Indicum siliqua cordata. Morison, Hist. Pl. Oxon. **3**: 529. 1699.

Solanum urens fructu cordato. Morison, l. c. Sect. 13. *t. 2. f. 12.*

Capsicum siliqua propendente, rotunda & cordiformi. Tournef. Inst. 153. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.— Miller, Gard. Dict. 1771 [6th ed.].

spherical, or subconical, 1–1½ in. diam., very smooth, glossy, rarely obscurely wrinkled or furrowed; flesh about ⅛ in. thick, dark red, very pungent.

YELLOW OXHEART.* A yellow form of the Oxheart variety has been known, but now seems to have dropped out of cultivation.

A A Shrubby, perennial.

a Fruit oblong, acuminate, usually embraced by calyx.

C. FRUTESCENS L.

Capsicum frutescens Linn. Hort. Cliff. 60. 1737; Sp. Pl. 189. 1753; 271, 1762 [ed. 2], (in part).— Gouan, Hort. Monsp. 111. 1762.— Miller, Gard. Dict. 1771 [ed. 6. no. 9].— Aublet, Hist. Pl. Guiane **1**: 219. 1775.— Linn. Syst. **14**: 227. 1784 [ed. 14. Murray].— Aiton, Hort. Kew. **1**: 254. 1789.— Loureiro, Fl. Cochin. **1**: 128. 1790; **1**: 158. 1793 [ed. Willd.].— Lam. Enc. Meth. **2**: 26. 1793 [no. 2395].— Linn. Sp. Pl. **1**: 1051. 1797 [ed. Willd.].— Miller, Gard. Dict. 1797 [ed. Martyn].—Poiret, Enc. Meth. **5**: 325. 1804.— Persoon, Syn. Pl. **1**: 230. 1805.— Hornem. Hort. Hafn. **1**: 224. 1813.— Kunth, Nov. Gen. Sp. Pl. **3**: 48. 1818.— Linn. Syst. **4**: 563. 1819 [ed. Röm. et Schult.].— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Moon, Cat. Brit. Ind. 16. 1824.— Fingerh. Monogr. 17. *t. 4. f. c.* 1832.— Roxb. Fl. Ind. **1**: 574. 1832.— Nees von Esenb. Trans. Linn. Soc. **17**: 63. 1837.— Don, Hist. Dich. Pl. **4**: 446. 1838.— Sendt. in Mar.

Capsicum siliqua propendente, oblonga & cordiformi. Tournef. Inst. 153. 1700.— Tillus, Cat. Pl. Hort. Pisa. 30. 1723.

Piper Indicum cordatum. Hort. Eyst. 1. Autum. Ord. 1: 13. *f. 2.* 1713.

Piper Indicum cordatum oblongum. Hort. Eyst. l. c. *f. 1.*

Capsicum; fructu Cordiformi, plerumque nutante rubro. Miller, Gard. Dict. 1731 [no. 7].

Solanum mordens fructu erecto cordiformi rubro. Weinmann. Phyt. 349. *t. 929. f. c.* 1745.

Capsicum fructu cordiformi erecto. Haller, Hort. Gott. 216. 1753.

* *Capsicum cordiforme globosum* Fingerh. Monogr. 30. *t. 10. f. c.* 1832.— Dunal in DC. Prodr. **13**[1]: 427. 1852.

Capsicum strictum Fingerh. Monogr. 21. *t. 5. f. a.* 1832.— Dunal in DC. Prodr. **13**[1]: 422. 1852.

Capsicum; fructu Cordiformi, nunc erecto, nunc nutante flavo. Miller, Gard. Dict. 1731 [no. 12].

Solanum mordens, fructu erecto cordiformi, luteo. Weinmann. Phyt. 349. *t. 929. f. b.* 1745.

Capsicum fructu cordiformi minori luteo. Browne, Hist. Jam. 176. 1756.

tius, Fl. Bras. **10**: 142. 1846.— Hooker, Niger Fl. 162. 1849.— Dunal in DC. Prodr. **13**[1]: 413. 1852.— Miquel, Fl. Ned. Ind. **2**: 660. 1856.— Grisebach, Fl. Ind. 436. 1864.— Hemsley, Biol. Cent.-Am. **2**: 423. 1881–82.—Hooker, Fl. Brit. Ind. **4**: 239. 1885.— Gray, Syn. Fl. **2**: 231. 1888.— Chapman, So. Fl. 323. 1896.

Capsicum minimum Miller, Gard. Dict. 1771 [no. 10. ed. 6].—Moon, Cat. Pl. Cey. 16. 1824.— Roxb. Fl. Ind. **1**: 574. 1832.— Miquel, Fl. Ned. Ind. **2**: 659. 1856.— Dunal in DC. Prodr. **13**[1]: 415. 1852.

Capsicum conicum Lam. Enc. Meth. 2. 1793 [no. 2890]. — Poiret, Enc. Meth. **5**: 327. 1804.

Capsicum Havanense Kunth, Nov. Gen. Sp. Pl. **3**: 48. 1818.— Don, Hist. Dich. Pl. **4**: 446. 1838.

Capsicum Comarim Vell. Fl. Flum. Repr. in Rio de Jan. Arch. Mus. Nac. **5**: 59. 1881.

Capsicum odoriferum Vell. l. c. 60.— Fide Index Kewensis.

Capsicum toxicarium Pöppig.— Fingerh. Monogr. 32. 1832.—Fide Index Kewensis.

Capsicum frutescens minus Fingerh. Monogr. 17. 1832. — Dunal in DC. Prodr. **13**[1]: 413. 1852.

Capsicum fastigiatum (Blume). Nees von Esenb. Trans. Linn. Soc. **17**: 64. 1832.— Don, Hist. Dich. Pl. **4**: 446. 1838. — Wight, Illust. Ind. Bot. **2**: 198. 1850.— Dunal in DC. Prodr. **13**[1]: 416. 1852.— Miquel, Fl. Ned. Ind. **2**: 659. 1856.

Capsicum cereolum Bertol. Hort. Bonon. Pl. Nov. **1**: 6. *t. 2*. 1838.—Fide Index Kewensis.

Capsicum odoratum Steud. Nom. **1**: 279. 1840.— Fide Index Kewensis.

Capsicum flexuosum Sendt. in Martius, Fl. Bras. **10**: 143. 1846.— Dunal in DC. Prodr. **13**[1]: 413. 1852.

Capsicum Abyssinicum A. Rich. Fl. Abyss. **2**: 96. 1851.

Capsicum chlorocladum Dunal in DC. Prodr. **13**[1]: 415. 1852.— Hemsley, Biol. Cent.-Am. **2**: 423. 1881–82.

Capsicum crispum Dunal in DC. Prodr. **13**[1]: 415. 1852.

Capsicum fructescens multilobatum Dunal, l. c. 413.

Capsicum flexuosum Perrottetii Dunal, l. c.

Capsicum crispum Piper rabiosum Dunal, l. c. 416.

Capsicum annuum frutescens Kuntze, Revis. Gen. Plant. 449. 1891.

Capo-Malago. Rheede, Hort. Malab. **2**: 109. *t. 56*. 1679.

Capsicum sive Piper Indicum siliqua longa gracile Corallii coloris. Morison, Hist. Pl. Oxon. **3**: 529. 1699.

Capsicum sive Piper Barbadiense fructu Berberidis acerrimo. Morison, Hist. Pl. Oxon. **3**: 530. 1699.

Spur-Pepper. Hughes, Hist. Barb. 213. 1750.— Fide Maycock, Fl. Barb. 104. 1830.

Plants shrubby, perennial, 2½–6 ft. high. Branches angular, often channeled, puberulent, or pubescent, especially on the younger portions, usually greatly enlarged

at the nodes, green, or sometimes purplish striate, slightly purple at the nodes. Leaves broadly ovate acuminate, 3–6 in. long, 2–3½ in. wide, usually puffed or wrinkled, more or less pubescent especially along the veins. Petioles medium, usually subciliate. Peduncles slender, 1–2 in. long, often in pairs, usually longer than the fruit. Calyx usually cup-shaped embracing base of the fruit, teeth short. Corolla white or greenish-white, spreading ⅜–½ in., often with ocherous markings in the throat. Fruit red, ovate, obtuse, or oblong acuminate, ¾–1¼ in. long, ¼–¾ in. diam.

As the fruit of this species does not ripen freely except in tropical and subtropical latitudes it is not grown commercially in the north. However a number of cultivated varieties from Mexico and Brazil,* which evidently belong to this species, have been grown by Dr. Sturtevant at Geneva, New York, and by the writer at the Missouri Botanical Garden. By starting them early in the season with the aid of artificial heat most of the varieties produced some ripe fruit. The plants however did not attain the size and vigor which they reach in their native habitat. The fruit is often called "bird pepper."

a a Fruit ovate or subround, usually seated on the calyx.

C. frutescens baccatum (L.).†

Capsicum baccatum Linn. Mant. 47. 1767.—Aiton, Hort. Kew. **1**: 253. 1789.—Linn. Syst. 226. 1784 [ed. 14 Murray].—Loureiro, Fl. Cochin **1**: 127. 1790; **1**: 157. 1793 [ed. Willd.].—Lam. Enc. Meth.

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* The following varieties sent from Mexico by Dr. Palmer are referred to this species:— *Chili de arvol*, *Chili pico de pijaro*, *Chili Piquin*, *Chili Unque*, and *Mirasol*, together with the following sent from Brazil by Prof. O. A. Derby:— *Pimentas cemerim grande*, *Pimentas dido de dama*, *Pimentas Malagueti*, and *Pimentas pitanga*.

† Supposed wild specimens examined from Bolivia (Bang, no. 1126, 1891); Paraguay (Morong, no. 961, 1888–90); Mexico (Pringle, 1888); Texas (Pammel, 1888; Trelease, 1897).

The following varieties sent from Brazil by Prof. Derby are referred to this group:— *Pimentas Mariana*, and *Pimentas Cumary*, together with one from Mexico by Dr. Palmer,—*Chiltepin*.

2: 26. 1793 [no. 2393].— Linn. Sp. Pl. **1**: 1050. 1797 [ed. Willd.].— Poiret, Enc. Meth. **5**: 325. 1804.— Persoon, Syn. Pl. **1**: 229. 1805.— Hornem. Hort. Hafn. **1**: 224. 1813.— Kunth, Nov. Gen. Sp. Pl. **8**: 48. 1818.— Linn. Syst. **4**: 564. 1819 [ed. Röm. et Schult.].— Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Fingerh. Monogr. 18. *t. 4. f. a.* 1832.— Don, Hist. Dich. Pl. **4**: 447. 1838.— Sendt. in Martius, Fl. Bras. **10**: 146. 1846.— Dunal in DC. Prodr. **13**[1]: 420. 1852.— Miquel, Fl. Ned. Ind. **2**: 660. 1856.— Grisebach, Fl. British W. Ind. 436. 1864.— Hemsley, Biol. Cent.-Am. **2**: 423. 1881–2.— Gray, Syn. Fl. **2**: 231. 1888.

Capsicum pulchellum Salisb. Prodr. 134. 1796.— Fide Index Kewensis.

Capsicum microcarpum DC. Cat. Hort. Monsp. 86. 1813.— Hooker, Niger Flora 162. 1849.— Don, Hist. Dich. Pl. **4**: 446. 1838.— Linn. Sp. Pl. **4**: 565. 1819 [ed. Röm. et Schult.].— Sendt. in Martius, Fl. Bras. **10**: 146. 1846.— Dunal in DC. Prodr. **13**[1]: 420. 1852.— Fingerh. Monogr. 19. *t. 4. f. b.* 1832.

Capsicum globiferum Meyer, Fl. Esseq. 113. 1818.— Linn. Syst. **4**: 808. 1819 [ed. Röm. et Schult.].— Fingerh. Monogr. 19. 1832.— Don, Hist. Dich. Pl. **4**: 446. 1838.— Dunal in DC. Prodr. **13**[1]: 421. 1852.

Capsicum micranthum Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.— Don, Hist. Dich. Pl. **4**: 447. 1838.

Capsicum ciliare Link, Enum. Pl. Hort. Reg. Berol. **1**: 190. 1821.

Capsicum Cumanense Fingerh. Monogr. 17. 1832.— Dunal in DC. Prodr. **13**[1]: 417. 1852.

Capsicum Willdenowii Don, Hist. Dich. Pl. **4**: 447. 1838.

Capsicum villosum Sendt. in Martius, Fl. Bras. **10**: 144. 1846.— Dunal in DC. Prodr. **13**[1]: 418. 1852.

Capsicum villosum latifolium Sendt. l. c. 145.— Dunal, l. c. 419.

Capsicum villosum muticum Sendt. l. c.— Dunal, l. c.

Capsicum campylopodium Sendt. l. c. 144.— Dunal, l. c. 416.

Capsicum Schottianum leptophyllum. Dunal, l. c.

Capsicum mirabile (Mart.) Sendt. l. c.— Dunal, l. c. 417.

Capsicum mirabile grandiflorum Sendt. l. c.— Dunal, l. c.

Capsicum Schottianum Sendt. l. c.— Dunal, l. c. 416.

Capsicum Rabenii Sendt. l. c. 145.— Dunal, l. c. 419.

Capsicum parvifolium Sendt. l. c.— Dunal, l. c.

Capsicum parvifolium Sellowianum Dunal, l. c.

Capsicum hispidum Dunal, l. c.— Hemsley, Biol. Cent.-Am. **2**: 423. 1881–82

Capsicum hispidum glabriusculum Dunal, l. c. 420.

Capsicum glandulosum Dunal, l. c. 417.

Capsicum laurifolium Dunal, l. c. 418.

Capsicum salicifolium Dunal, l. c.

Capsicum gracilipes Dunal, l. c.

Capsicum angustifolium Dunal, l. c. 420.

Capsicum microphyllum Dunal, l. c. 421.

Capsicum annuum baccatum Kuntze, Revis. Gen. Plant. 449. 1891.

Capsicum brevioribus siliquis. Lobel, Pl. Hist. 172. *f.* 1576.

Siliquastrum rotundum angustifolium. Bassaeus, Eicones 859. *f.* 1590.— Tabern. Kreuterbuch **2**: 530. *f.* 1591; Volkom. Kreuterbuch **2**: 559. *f.* 1613.

Capsicum, Piper Indicum brevioribus siliquis. Lobel. Icones Stirp. 817. 1591.

Capsicum Brasilianum. Garcias ab Horto, Aromatum 388. 1593.— Clus. Exot. 340. *f.* 1605.— Pancovius. Herb. *f. 297.* 1673.

Capsicum minimis siliquis. Gerarde, Herball 292. *f. 2.* 1597; 364. *f. 3.* 1636.— Dodon. Hist. Stirp. Antv. 705. 1583; 717. 1616.

Piper Brasilianum. Greg. de. Reg. in Clus. Cur. Post. 104. 1611.

Capsicum minus Brasilianum. Parkinson, Theat. Bot. 356–357. *f.* 1640.

Quiya apua. Marcg. in Piso, De Med. Bras. 39. 1648.

Piper siliquosum magnitudinis baccarum Asparagi. Bauhin, Hist. Pl. **2**: 944. *f.* 1651.

Capsicum Brasilianum fructu rotundo. Munting, Waare Oeffen. Pl. 341. 1682.

Capsicum minus fructu rotundo, erecto, parvo, acerrimo. Sloane, Cat. Pl. Jam. 111. 1696.

Capsicum sive Piper Brasilianum fructu erecto è rotundo oblongo minimo. Morison, Hist. Pl. Oxon. **3**: 530. 1699.

Capsicum minus rubrum. Rumph. Herb. Amboin. **5**: 248. *t. 88. f. 2.* 1747.

Capsicum; fructu parvo, rotundo, acerrimo. Miller, Gard. Dict. 1731 [no. 15].

Plants 1–3 ft. high, under cultivation often 6 ft. Branches numerous, slender, fastigiate, flexuose, usually quite densely purple striate, scabrous, pubescent. Leaves ovate acuminate, rather abruptly narrowing into the petioles, solitary or in twos, more or less pubescent along the veins and sometimes on the surface. Petioles short, usually hairy, broadened at base. Peduncles solitary or in twos, extra axillary, vertical (giving a peculiar character to the plant), slender, 1–1¼ in. long, smooth or on young specimens subhairy. Calyx short, cyathiform, subhairy, subciliate. Corolla small, spreading about ½ in., greenish white. Fruit ovate or subround, about ¼ in. diam. Unripe fruit sometimes changing from green to blackish spotted, finally ripening into a red or yellow.

The following garden varieties have not been sufficiently studied by me for satisfactory arrangement in the synopsis:— *Yellow Gem*, Williams' Cat. 1878.— *Tom Thumb*, Batchelor, 1887.— *Boston Squash*, *Cheese*, *Golden Dwarf*, *Red Upright*, *Yellow Mango*, Bailey, Annals of Horticulture **1889**: 125.— *Galveston Red*, *Weissfrüchtiger Pfeffer*, Haage & Schmidt, Cat. 1893.— *Black Fruited Chili*, *Scarlet Maddaloni*, Benary, Cat. 1893–4.— *Columbus goldgelber Pfeffer*, *Columbus rother Pfeffer*, *Sirius Pfeffer*, *Violetter Pfeffer*, Haage & Schmidt, Cat. 1897.

The following species, apparently not in cultivation in Europe or the United States, and of which I have not seen authentic material, cannot be placed in the preceding synopsis because of the absence of certain essentials from such descriptions as I have seen. Those in italics are introduced into the synopsis as synonyms on the authority of the Index Kewensis.

CAPSICUM CONOIDEUM Miller, Gard. Dict. 1768 [no. 1.ed. 8].

CAPSICUM CHINENSE Jacq. Hort. Vindob. **3**: 38. *t. 67*. 1776.

Capsicum pulchellum Salisb. Prodr. 134. 1796.= C. frutescens baccatum.

CAPSICUM PUBESCENS Ruiz & Pav. Fl. Per. **2**: 30. 1797.

CAPSICUM CAERULESCENS Bess. Cat. Hort. Crem. 27. 1811.

Capsicum Tournefortii Bess. l. c.= C. annuum longum.

Capsicum torulosum Hornem. Hort. Hafn. Suppl. 27. 1819.= C. annuum acuminatum.

CAPSICUM AGGREGATUM Willd. Herb.— Linn. Syst. **4**: 809. 1819 [ed. Röm. et Schult.].

Capsicum Quitense Willd. Herb.— Linn. Syst. l. c. = C. annuum longum.

CAPSICUM DICHOTOMUM Vell. Fl. Flum. Repr. in Rio de Jan. Arch. Mus. Nac. **5**: 60. 1881.

CAPSICUM INAEQUALE Vell. l. c. 59.

Capsicum odoriferum Vell. l. c. 60.= C. frutescens.

Capsicum toxicarium Pöppig.— Fingerh. Monogr. 32. 1832. = C. frutescens.

CAPSICUM USTULATUM Paxton, Mag. Bot. **5**: 197. 1838.

Capsicum cereolum Bertol. Hort. Bonon. Pl. Nov. **1**: 6. *t. 2*. 1838. = C. frutescens.

Capsicum odoratum Steud. Nom. **1**: 279. 1840 [ed. 2]. = C. frutescens.

CAPSICUM BAUHINI Dunal in DC. Prodr. 13[1]: 428. 1852.
CAPSICUM HORNEMANNI Dunal, l.c. 429.
Capsicum pubescens Dunal, l. c. 421. = C. frutescens baccatum.
Capsicum Narunca Dunal, l. c. 414. = C. annuum longum.
CAPSICUM MAXIMOWICZII Regel & Rach, Ind. Sem. Hort. Petrop. 40. 1858.
CAPSICUM NEPALENSIS Drury, Useful Pl. Ind. 112. 1858.
CAPSICUM ANOMALUM Franch. & Sav. Enum. Pl. Jap. 2: 452. 1879.
CAPSICUM RACEMIGERME (?) Veitch, Traveler's Notes 178. 1896.

The following species apparently does not belong to this genus: —

CAPSICUM TORULOSUM Vell. Fl. Flum. Repr. in Rio de Jan. Arch. Mus. Nac. 5: 59. 1881.

EXPLANATION OF PLATES ILLUSTRATING CAPSICUM.

All of the illustrations were drawn from nature or from original photographs by Miss Grace E. Johnson, under supervision of the author. Except where otherwise stated all figures are of natural size.

Plate 8.— Details of flower and fruit. 1, flowers in different stages of expansion; 2, open flower bud × 3; 3, flower and opened corolla; 4, a stamen from back, front and side × 5; 5, one-celled cherry pepper, in cross section; 6, two, three, and four-celled forms of the larger peppers, in cross section.

Plate 9.— 1, Capsicum frutescens; 2, Coral Gem; 3, Orange-red Cluster; 4, Red Cluster.

Plate 10.— 1, Chilli; 2, Yellow Chilli; 3, two forms of Long Cayenne.

Plate 11.— 1, two forms of Nepal Chilli; 2, Ivory Tusk.

Plate 12.— 1, Yellow Cayenne; 2, Long Yellow.

Plate 13.— 1, Cardinal; 2, Elephant's Trunk.

Plate 14.— 1, County Fair; 2, Procopp's Giant:— both reduced.

Plate 15.— 1, Procopp's Giant; 2, A slightly tapering form of Emperor.

Plate 16.— Monstrous.

Plate 17.— Sweet Spanish, natural size and reduced.

Plate 18.— Oblate forms of Bell.

Plate 19.— 1, Bell; 2, Sweet Mountain: — both reduced.

Plate 20.— Sweet Mountain.

Plate 21.— 1, Ruby King; 2, Golden Dawn.

Plate 22.— 1, Golden King; 2, Golden Upright.

Plate 23.— Short form of Brazilian Upright with cross and longitudinal sections showing position of the seeds.

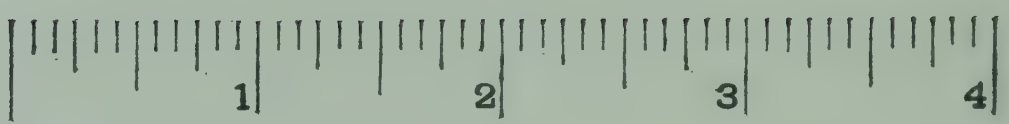
Plate 24.— Squash, usual and less grooved forms.

Plate 25.— 1, Squash; 2, Celestial; 3, Kaleidoscope:— all reduced.

Plate 26.— 1, Celestial; 2, Kaleidoscope.

Plate 27.— 1, Kaleidoscope; 2, Etna; 3, Red Wrinkled; 4, Little Gem.

Plate 28.— 1, Occasional form of Red Wrinkled; 2, Cherry; 3, Yellow Cherry; 4, Cranberry,— usual, conical, and elongated forms; 5, Oxheart.



FOUR INCHES, DIVIDED INTO TWELFTHS.

INDEXES TO NAMES OF CAPSICUMS.

POPULAR NAMES.

(*Synonyms in Parenthesis.*)

American bonnet pepper, (87).

Bell, 84.
Bell, Yellow, (85).
Bird pepper, 59.
Bird's eye, (93).
Black fruited Chili, 102.
Black Nubian, 76.
Black podded, (76).
Blue podded, (76).
Bonnet pepper, (87).
Boston squash, 102.
Brazilian sweet upright, New, (86).
Brazilian upright, 86.
Bull nose, (84).

Capo-Malago, (98).
Cardinal, 78.
Cayenne, 67, (71).
Cayenne of Commerce, (67).
Cayenne, Long, (70), 71.
Cayenne, Long yellow, 72.
Celestial, 89.
Cheese, (102).
Cherry, 93.
Cherry pepper, Round or large, (93).
Cherry pepper, Yellow fruited, (95).
Cherry, Yellow, 95.
Childs' Improved Celestial, (89).
Chilenischer scharfer Pfeffer, (70).
Chili, (70).
Chili de Arvol, 99.
Chili, Black fruited, 102.
Chili Mirasol, 99.
Chili pico de pijaro, 99.
Chili Piquin, 99.
Chili Unque, 99.
Chilli, 70, (72).
Chilli, Nepal, 73.
Chilli, Yellow, 71.
Chilli, Yellow Nepal, 73.
Cluster, Japan, (63).
Cluster, Red, 69.
Cluster, Yellow, 69.
Columbus goldgelber Pfeffer, 102.
Columbus rother Pfeffer, 102.
Coral, (77).
Coral gem, 66.
County Fair, 78.
Cranberry, (93).
Creole, (93).
Crimson queen, (83).

Dawn, Golden, 85.
Dwarf, Golden, 102.
Dwarf early red squash, New, (87).

Early red squash, New dwarf, (87).
Eckiger dicker kurzer rother süsser Pfeffer, (85).
Elephanten-Rüssel, (80).
Elephant's trunk, 80.
Emperor, 83.
Etna, 89.

Fancy red wrinkled, Thorburn's, (91).
French, Red, (93).

Galveston red, 102.
Gelber Trauben-Pfeffer (69).
Gem, Little, 93.
Gem, Yellow, 102.
Giant, Procopp's, 80.
Giant emperor, (83).
Golden dawn, 85.
Golden dwarf, 102.
Golden king, 85.
Golden mango, (85).
Golden queen, Mammoth, (85).
Golden upright, 86.
Golden upright sweet mango, (86).
Grossum, (83).

Imported celestial, Childs', (89).
Ivory Tusk, 80.

Japan cluster, (69).

Kaleidoscope, 90.
King, Golden, 85.

King, Ruby, 85.
Kirschförmiger gelber Pfeffer, (95).
Kirschförmiger rother Pfeffer, (94).

Langer gelber Pfeffer, (79).
Langer rother, Pfeffer, (77).
Large cherry pepper, (93).
Large scarlet, New, (85).
Large sweet Spanish, (84).
Liebesapfelfrüchtiger gelber Pfeffer, (88).
Liebesapfelfrüchtiger rother Pfeffer, (87).
Little gem, 60, 93.
Long Cayenne, (70), 71.
Long red, 77.
Long yellow, 79.
Long yellow Cayenne, 72.
Long yellow French, (79).

Maddaloni, Scarlet, 102.
Mammoth, Orange, (85).
Mammoth, Spanish, (84).
Mammoth golden queen, (85).
Mango, Golden, (85).
Mango, Golden dawn, (85).
Mango, Golden upright sweet, (86).
Mango, Yellow, 102.
Miniature Tom Thumb, (93).
Monstrous, 83.
Mountain, Sweet, 85.

Negro pepper, (66).
Nepal chilli, 73.
Nepal chilli, Yellow, 73.
New Brazilian sweet upright, (86).
New dwarf early red squash, (87).
New large scarlet, (85).
New sweet Spanish, (84).
Nocre, Yellow, (85, 86).
Nubian, Black, 76.

Orange mammoth, (85).
Orange-red cluster, 67.
Orangerother Trauben-Pfeffer, (67).
Oxheart, 96.
Oxheart, Yellow, 97.

Pfeffer, Chilenischer scharfer, (70).
—— Columbus, 102.
—— eckiger dicker kürzer rother süsser, (85).
—— Elephanten-Rüssel, (80).
—— gelber Trauben-, (69).
—— kirschförmiger, (94, 95).
—— langer gelber, (79)
—— langer rother (77).
—— liebesapfelfrüchtiger, (87, 88).
—— orangerother Trauben-, (67).
—— Procopp's riesen, (80).
Pfeffer, rother milder spanischer, (84).
—— rother Trauben-, (69).
—— runzliger, (91).
—— schwarzer nubischer, (76).
—— sehr grosser milder monströser, (83).
—— Sirius, 102.
—— Trauben-, (67, 69).
—— violetter, 102.
—— weissfrüchtiger, 102.
Piment airelle rouge, (93).
—— a bouquet rouge, (69).
—— carré doux d'Amérique, (85).
—— carré jaune hatif, (85).
—— de Cayenne, (71).
—— cerise, (94).
—— cerise jaune, (95).
—— du Chili, (70).
—— chinois, (89).
—— cloche, (84).
—— doux d'Espagne, (84).
—— gros carré doux, (84).
—— jaune, long, (79).
—— mammoth jaune d'or, (85).
—— monstrueux, (83).
—— noir, (76).
—— rouge, long, (77).
—— tomate, (87).
—— tomate jaune, (88).
—— tomate nain hatif, (87).
—— violet, (76).
Pimentas cemerim grande, 99.
—— Chiltepin, 99.
—— Cumary, 99.
—— dido de dama, 99.
—— Malagueti, 99.
—— Mariana, 99.
—— pitanga, 99.
Prince, Red (84).
Prince of Wales, 60, 93.
Princess of Wales, 91.
Procopp's Giant, 80.
Procopp's riesen Pfeffer, (80).
Purple, (76).

Queen, Crimson, (83).
Queen, Mammoth golden, (85).
Quince pepper, (84).
Quiya Apua, (101).

Red, Galveston, 102.
Red, Long, 77.
Red cardinal, (78).
Red chilli, (70).
Red cluster, 69.
Red Etna, (89).
Red French, (93).
Red prince, (84).
Red squash, New dwarf early, (87).
Red tomato, (87).

Red upright, 102.
Red wrinkled, 91.
Round cherry-pepper, (93).
Rother milder spanischer Pfeffer, (84).
Rother Trauben-Pfeffer, (69).
Ruby king, 85.
Runzliger gelber Pfeffer, (91).
Runzliger rother Pfeffer, (91).

Scarlet, New large, (85)
Scarlet Maddaloni, 102.
Schwarzer nubischer Pfeffer, (76).
Sehr grosser milder monströser Pfeffer, (83).
Sirius Pfeffer, 102.
Sore throat, (76).
Spanish, Sweet, 84.
Spanish, Yellow, 84.
Spanish mammoth, (84).
Spanish monstrous, (83).
Spur-pepper, (98).
Squash, 87.
Squash, Boston, 102.
Squash, New dwarf early red, (87).
Squash, Yellow, 88.
Sweet golden dawn, (85)
Sweet mango, Golden upright, (86).
Sweet mountain, 85.
Sweet Spanish, 84.
Sweet upright, New Brazilian, (86).

Tabasco, 59, 67.
Tenjikumamori, (69).
Thorburn's fancy red wrinkled, (91).
Tom Thumb, 102.
Tom Thumb, Miniature, (93).
Tomato-shaped, (87).
Tomato, Red, (87).
Trauben-Pfeffer, (67, 69).
Trompe d' éléphant, (80).
Turbilo pepper, (82).
Tusk, Ivory, 80.

Upright, Brazilian, 86.
Upright, Golden, 86.
Upright, New Brazilian sweet, (86).
Upright, Red, 102.
Upright sweet mango, Golden, (86).

Violetter Pfeffer, 102.

Weissfrüchtiger Pfeffer, 102.
Williams' little gem, (93).
Wrinkled, Red, 91.
Wrinkled, Yellow, 91.

Yellow, Long, 79.
Yellow bell, (85).
Yellow cherry, 95.
Yellow chilli, 71.
Yellow cluster, 69.
Yellow fruited cherry pepper, (95).
Yellow gem, 102.
Yellow mango, 102.
Yellow Nepal chilli, 73.
Yellow nocre, (85, 86).
Yellow oxheart, 97.
Yellow Spanish, 84.
Yellow squash, 88.
Yellow wrinkled, 91.

SPECIES AND BOTANICAL VARIETIES.

(*Synonyms in Parenthesis.*)

Abyssinicum, (98).
aggregatum, 102.
angulosum, (81).
—— conicum, (81).
—— macrocarpum, (81).
—— ovale, (81).
angustifolium, (100).
annuum, 65, (73, 94).
—— abbreviatum, 88.
—— acuminatum, 69, (70).
—— angulosum, (81).
—— cerasiforme, 92.
—— conoides, 65.
—— cordiforme, (96).
—— erectum, (74).
—— fasciculatum, 68.
—— frutescens, (98).
—— grossum, 80, (81).
annuum, longicarpum, (74).
—— longum, 73, (74).
—— ovoideum, (74).
—— proboscideum, (80).
—— rugosum, (81).
—— rugulosum, (81).
—— subangulosum, (74).
—— tetragonum, (87).
anomalum, 103.
Axi, (81).

baccatum, (99).
Bauhini, 103.
bicolor, (76).
—— purpureum, (77).

caerulescens, 102.
campylopodium, (100).

cerasiflorum, (94).
cerasiforme, (94).
— cerasiflorum, (94).
— luteum, (95).
— maurocarpum, (94).
— minus, (94).
ceratocarpum, (80).
cereolum, (98, 102).
Chamaecerasus, (81).
Chilense, (70).
Chinense, 102.
chlorocladum, (98).
ciliare, (100).
Comarim, (98).
conicum, (70, 98).
— orientale, (70).
conoides, (65).
— chordale, (65).
— oblongo-conicum, (65).
— sulcatum, (65).
conoideum, 102.
cordiforme, (96).
— cerasicarpum, (96).
— globosum, (97).
— majus, (96).
— minus, (96).
— olivaeforme, (96).
— subangulosum, (96).
crispum, (98).
— Piper rabiosum, (98).
Cumanense, (100).
curvipes, (73).
cydoniaeforme, (87).

dichotomum, 102.
dulce, (87).

fasciculatum, (68).
fastigiatum, (98).
flexuosum, (98).
— Perrottetii, (98).
frutescens, 61, 97.
— baccatum, (99).
— minus, (98).
— multilobatum, (98).

glandulosum, (100).
globiferum, (100).
gracilipes, (100).
grossum, (80).
— angulosum, (81).
— bifidum, (81).
— cerasiformis, (94)
— cordatum, (81).
— globosum, (81).
— lycopersicoides, (87, 88).
— monstrosum, (83).
— ovatum, (81).
— pomiferum, (81).

Hamiltonii, (77).
Havanense, (98).
hispidum, (100).
— glabriusculum, (100).
Hornemanni, 103.

inaequale, 102.

laurifolium, (100).
leucocarpum, (89).
longum, (71, 77).
— Cayennense, (71).
— ceratoides recurvum, (71).
— incrasatum, (78).
— luteum, (72, 79).
— rectum, (79).
— violaceum, (77).
luteum, (91).

Maximowiczii, 103.
micranthum, (100).
microcarpum, (100).
Milleri, (94).
minimum, (98).

Narunca, (77, 103).
Nepalensis, 103.
nigrum, (76).

odoratum, (98, 102).
odoriferum, (98, 102).
olivaeforme, (92).
ovatum, (92).
oxycarpum, (92).

parvifolium, (100).
pendulum, (73).
— majus, (73).
— minus, (73).
— tomentosum, (73).
pomiferum, (81).
pubescens, 102, (103).
pulchellum, (100, 102).
purpureum, (76).
pyramidale, (71).
— longicorne, (71).
— torulosum, (71).

Quitense, (76, 102).

Rabenii, (100).
racemigerme, 103.

salicifolium, (100).
Schottianum leptophyllum, (100).
silvestre, (81).
Sinense, (73).
sphaericum, (94).
strictum, (97).

tetragonum, (87).
tomatiforme, (87).

torulosum, (71, 102, 103).
Tournefortii, (74, 102).
toxicarium, (98, 102).

umbilicatum, (91).
ustulatum, 102.

villosum, (100).
—— latifolium, (100).
—— muticum, (100).
violaceum, (76).

Willdenowii, (100).

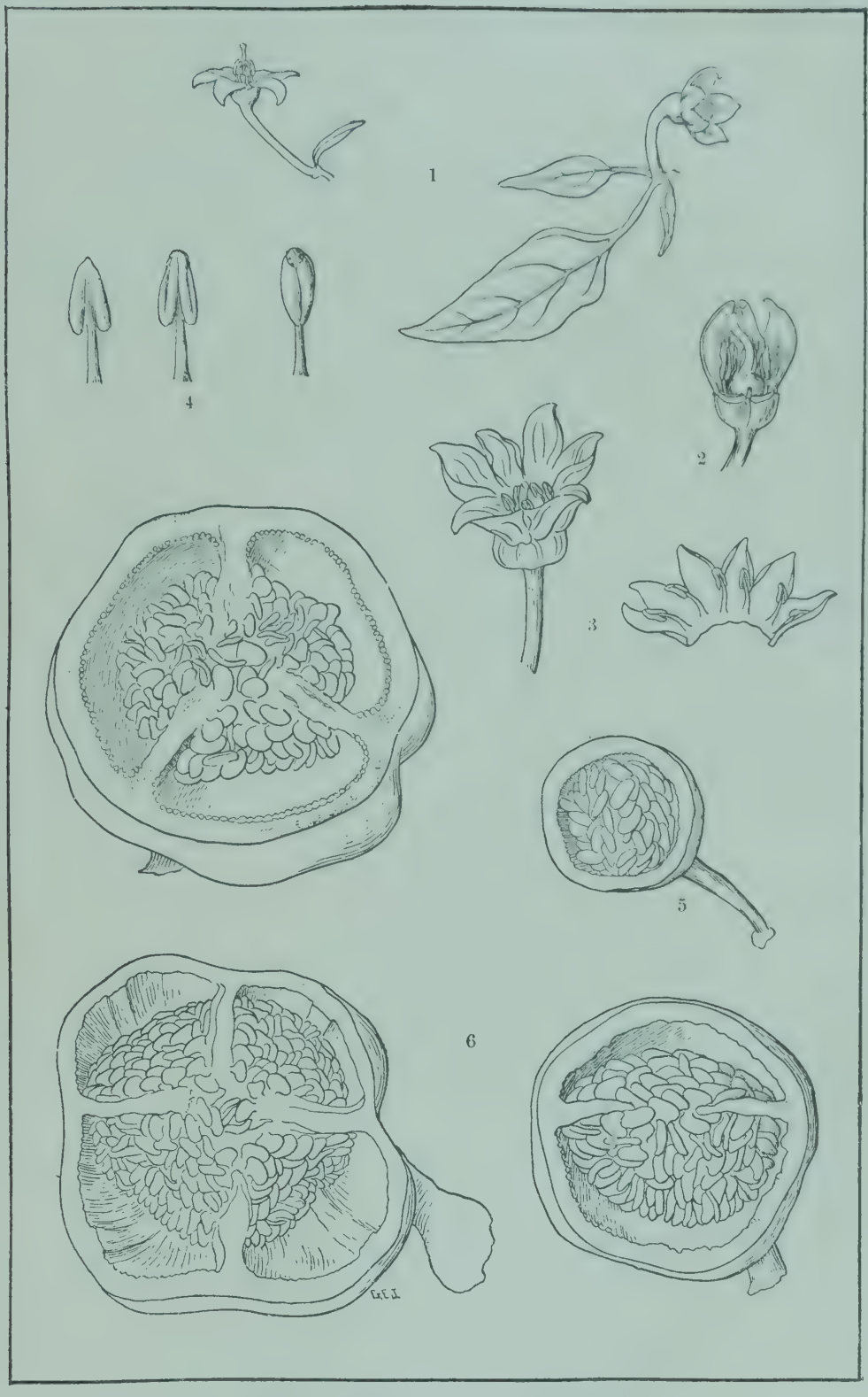
PRELINNEAN LATIN NAMES.

Capsicon latum, 81.
—— nigrum, 74.
—— rubeum, 74.
Capsicum Actuarij, 74.
—— Africanum, 82, 86.
—— Americanum, 78, 95.
—— —— latifolium, 89.
—— arborescens, 95.
—— Barbadiense, 98.
—— bifurcata siliqua, 82.
—— Brasilianum, 75, 101.
—— brevioribus siliquis, 100.
—— cordatum, 96.
—— erectum, 75.
—— —— pyramidale, 90.
—— exiguum, 65.
—— fructu aculeato, 90.
—— —— bifido, 82.
—— —— cordiformi, 97.
—— —— flavescente, 79, 91.
—— —— flavo, 79.
—— —— longo, 82.
—— —— maximo, 82.
—— —— minimo, 66.
—— —— oblongo, 75.
—— —— olivario, 92.
—— —— parvo, 101.
—— —— rotundo, 88, 95.
—— —— tereti, 82.
—— frutescens, 95
—— Indicum fructu aculeato, 90.
—— —— longum, 82.
—— —— maximum, 82.
—— —— minimum, 66.
—— —— minus, 72.
—— —— oblongum minus, 66.
—— —— perenne, 92.
—— —— Pomi amoris forma, 88.
—— —— propendentibus siliquis, 95.
—— —— siliqua bifurcata, 86.
—— —— siliqua flava, 79, 93.
—— —— siliqua longa, 82, 98.
—— —— siliquis oblongis, 75.
—— —— siliqua rotunda, 95.
—— —— siliquis surrectis, 75.
—— latifolium, 87, 88.
—— latis siliquis, 81.
—— latum, 81.
—— longioribus siliquis, 74.
Capsicum majus, 75.
—— minimis siliquis, 101.
—— minus Brasilianum, 101.
—— —— flavum, 71.
—— —— fructu parvo, 66.
—— —— fructu rotundo, 101.
—— —— rubrum, 101.
—— oblongioribus siliquis, 74.
—— oblongius, 71.
—— oblongum, 75.
—— Piper Indicum, 74, 101.
—— —— —— —— See *Piper*.
—— recurvis siliquis, 71.
—— rotundioribus siliquis, 94.
—— rotundum majus, 86.
—— siliqua flava, 79.
—— siliquis flavis, 79.
—— siliqua lata, 79, 82.
—— siliquis latis, 96.
—— siliqua latiore, 82.
—— siliquis longis, 72, 75, 77.
—— siliquis oblongis, 74.
—— siliqua Olivaria, 92.
—— siliqua Olivae forma, 92.
—— siliqua Propendente aurea, 79.
—— siliqua propendente Cerasiforma, 95.
—— siliqua propendente oblonga & cordiformi, 97.
—— siliqua propendente rotunda & cordiformi, 96, 97.
—— siliquis recurvis, 72, 79.
—— siliqua rotunda, 94.
—— siliquis rotundis, 94.
—— siliquis surrectis & oblongis, 66, 70, 71, 75.
—— siliquis surrectis Cerasi forma, 95.
—— siliquis surrectis rotundis, 95.
—— surrectum, 70.

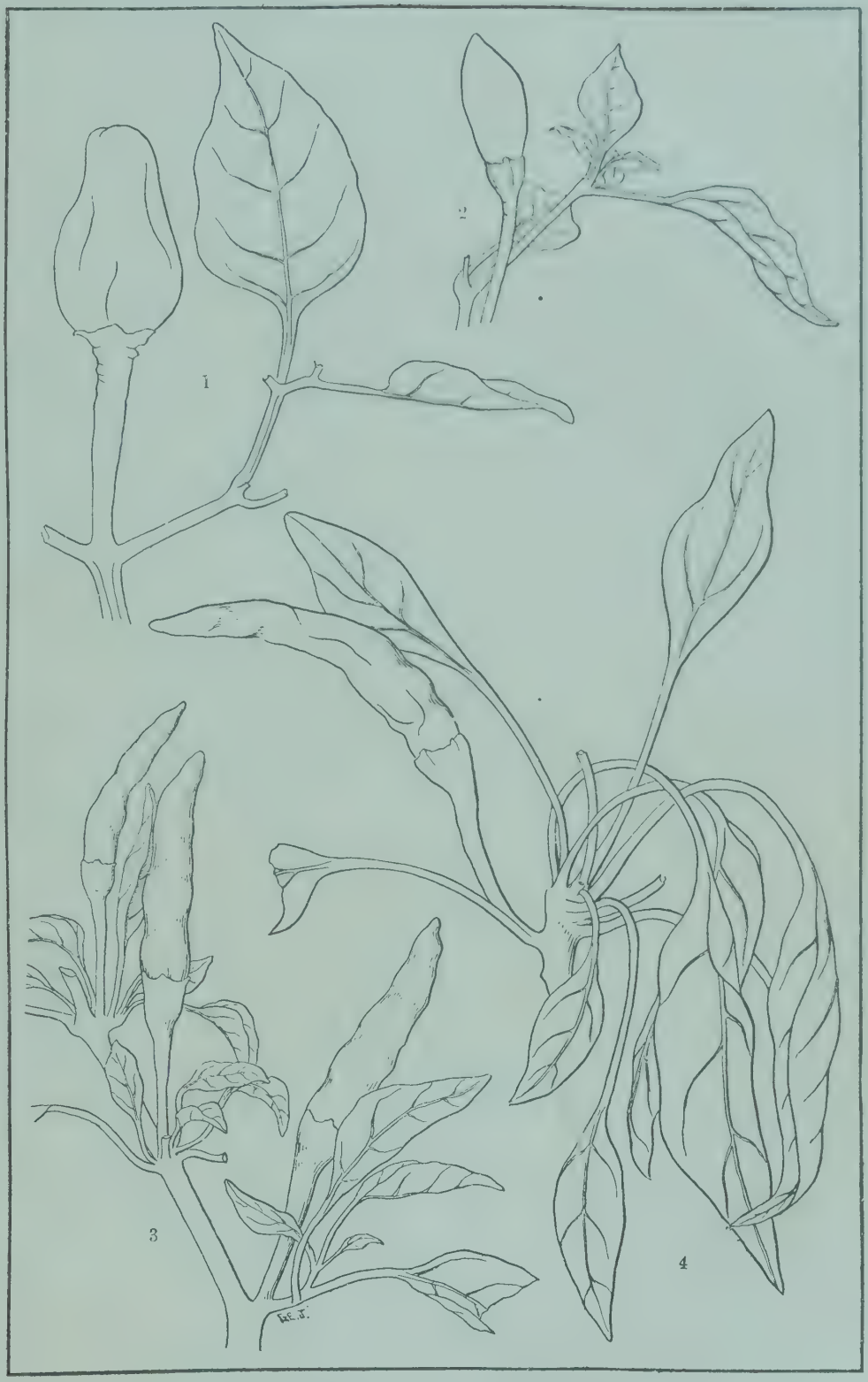
Piper Americanum vulgatior, 74.
—— Barbadiense, 98.
—— Brasilianum, 101.
—— Calecuticum, 72.
—— Capsicum, 82.
—— cordatum, 96.
—— erectum minus, 89.
—— Indicum, 71, 74, 82, 96.
—— —— aureum latum, 79.
—— —— bifurcata siliqua, 86.

Piper Indicum cordatum, 96, 97.
—— —— fructu aculeato, 90.
—— —— fructu dependente, 87.
—— —— latifolium, 88.
—— —— longioribus siliquis, 75.
—— —— longum maximum, 74.
—— —— longum maximum ventre tumido, 80.
—— —— maximum, 88.
—— —— maximum obtusum, 82.
—— —— maximum rotundum, 86
—— —— medium, 75.
—— —— medium erectum, 70.
—— —— minimum erectum, 66.
—— —— minus, 72.
—— —— oblongum, 66.
—— —— orbiculatum, 90.
—— —— perenne siliqua Olivae magnitudine, 92.
—— —— Pomi amoris forma, 88.
—— —— propendentibus siliquis, 75, 79, 92, 94, 95, 96.
—— —— rotundum aculeatum, 90.
—— —— rotundum maximum, 88.
—— —— siliqua bifurcata, 86.
—— —— siliquis Cerasi forma, 95.
—— —— siliqua cordata, 96.
—— —— siliqua flava, 79.
—— —— siliquis flavis, 79.
—— —— siliqua flava ovali, 93.
—— —— siliqua longa, 82, 98.
—— —— siliquis oblongis, 75.
—— —— siliqua rotunda, 95.
—— —— siliquis surrectis & oblongis, 65, 70, 75, 86.
—— —— siliquis surrectis Cerasi forma, 94.
—— —— siliquis surrectis rotundis, 86, 94, 96.
—— —— surrectis corniculis, 70.
Piper Indicum vulgatissimum, 75.
—— longum, 72, 75, 79.
—— oblongum erectum, 89.
—— —— exiguum erectum, 65.
—— —— recurvis siliquis, 74.
—— rotundum majus, 86, 95, 96.
—— siliqua flava, 79, 91.
—— cum siliqua lata, 82.
—— cum siliqua olivaria, 92.
—— cum siliqua rotunda, 94.
—— siliquosum, 72, 101.
—— vulgatissima, 75.

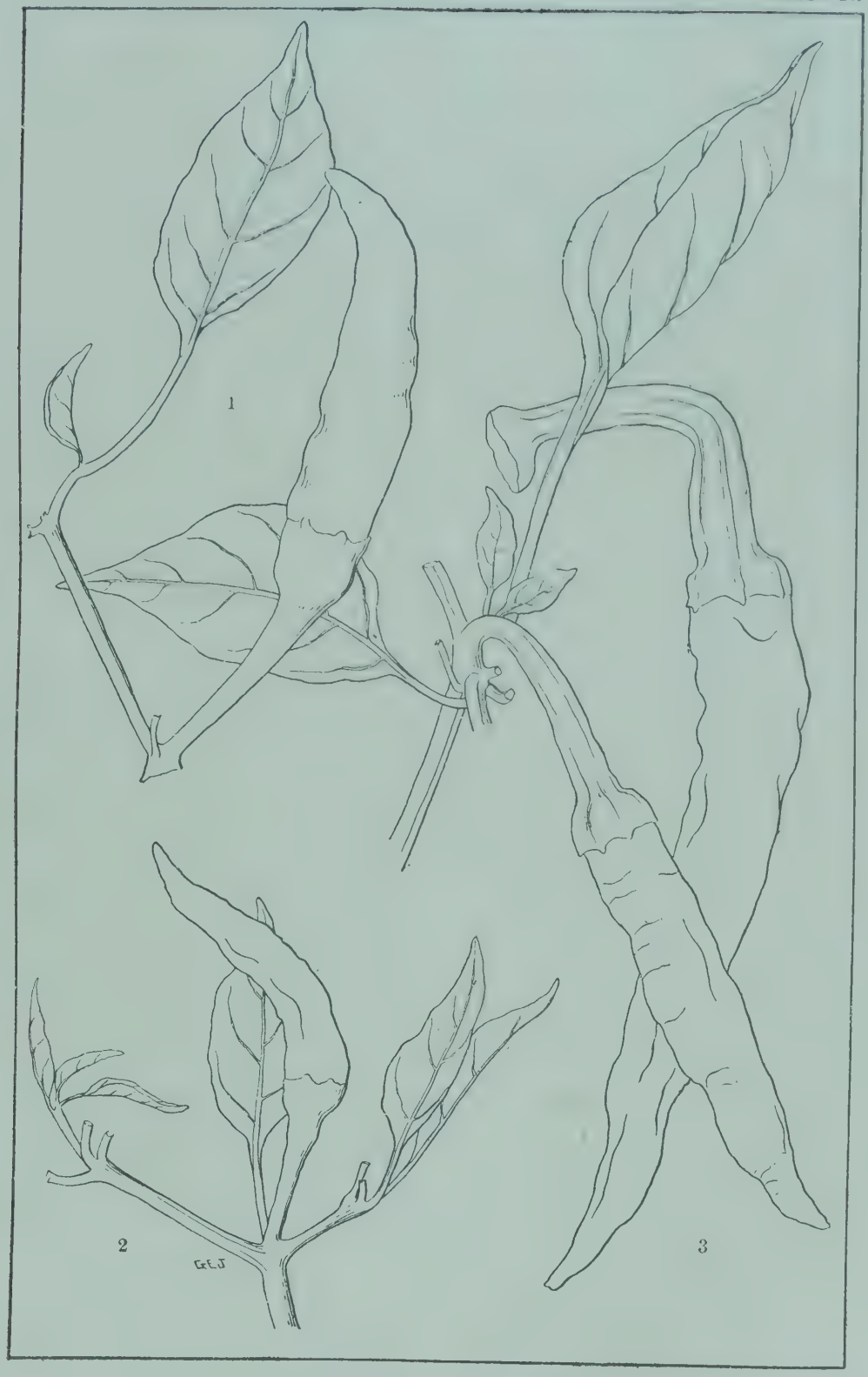
Siliquastrum cordatum, 96.
—— latum, 81.
—— varietas longum, 71.
—— majus, 74.
—— minus, 74.
—— oblongius, 71.
—— quartum, 81.
—— rotundum, 101.
—— varietas rotundum, 94.
—— tertium, 71.
Solanum Capsicum, 72, 75, 95.
—— medium, 75.
—— mordens bifurcata siliqua, 82.
—— —— fructu aureo lato, 79.
—— —— fructu erecto, 97.
—— —— fructu flavescente, 91.
—— —— fructu longo erecto, 70.
—— —— fructu propendente, 78.
—— —— fructu rotundo, 95.
—— —— mali Aethiopici, 87.
—— —— minus erectum, 66.
—— —— siliquis flavis, 79.
—— —— siliquis oblongis, 72.
—— urens fructu aculeato, 90.
—— —— fructu cordato, 96.
—— —— siliqua propendente, 72, 75, 92, 95.



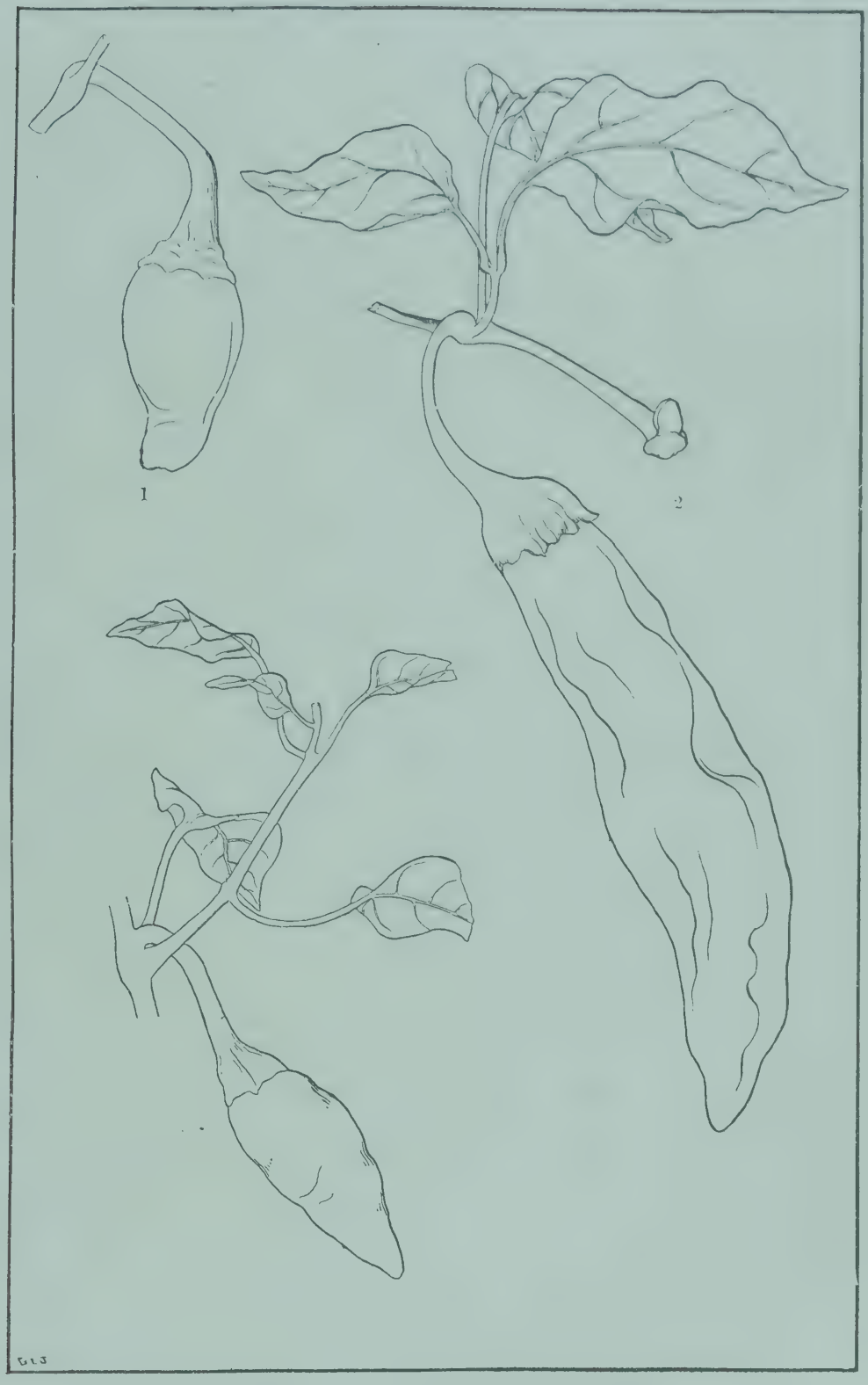
FLOWER AND FRUIT OF CAPSICUM.



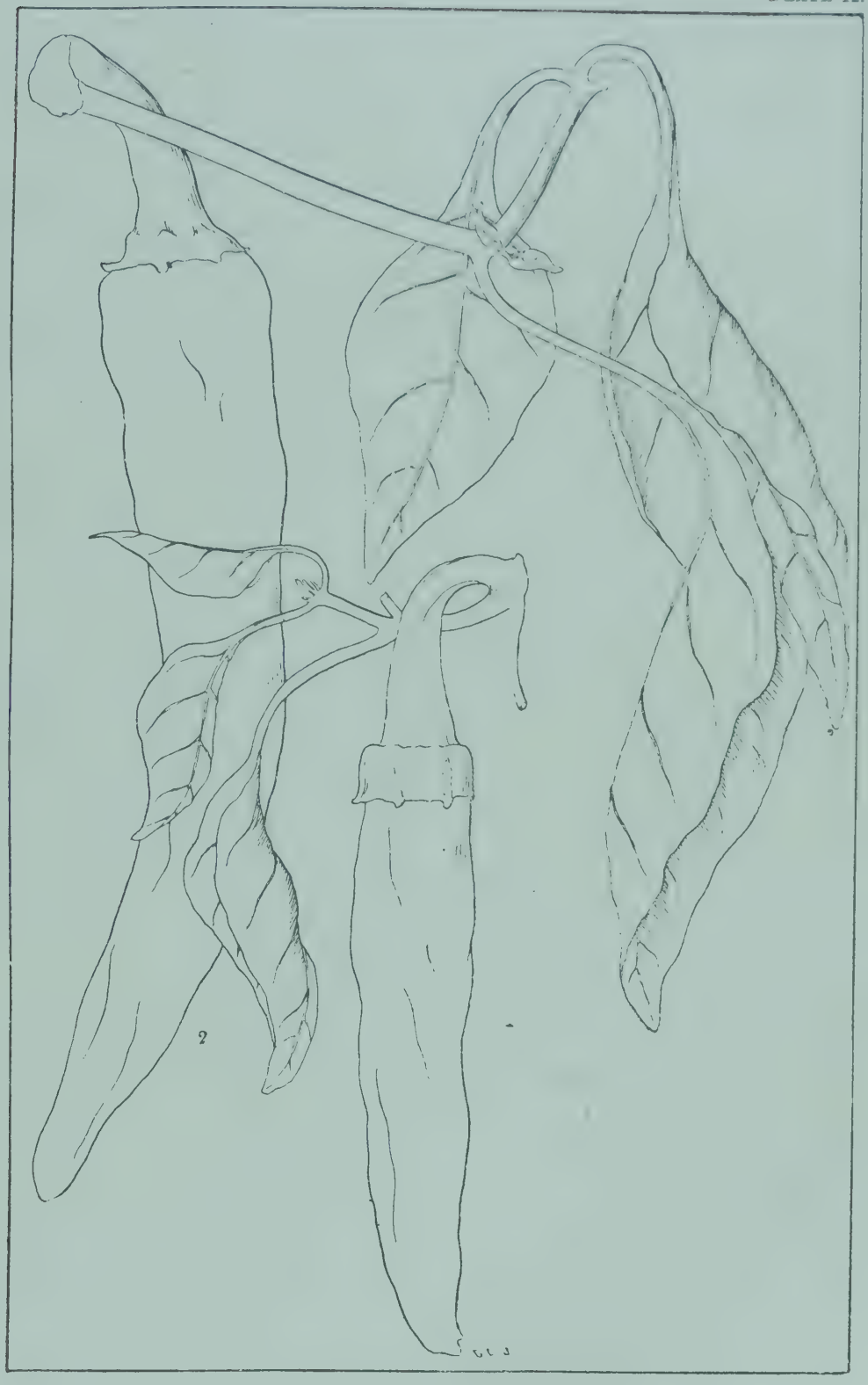
C. FRUTESCENS AND C. ANNUUM, VARS.



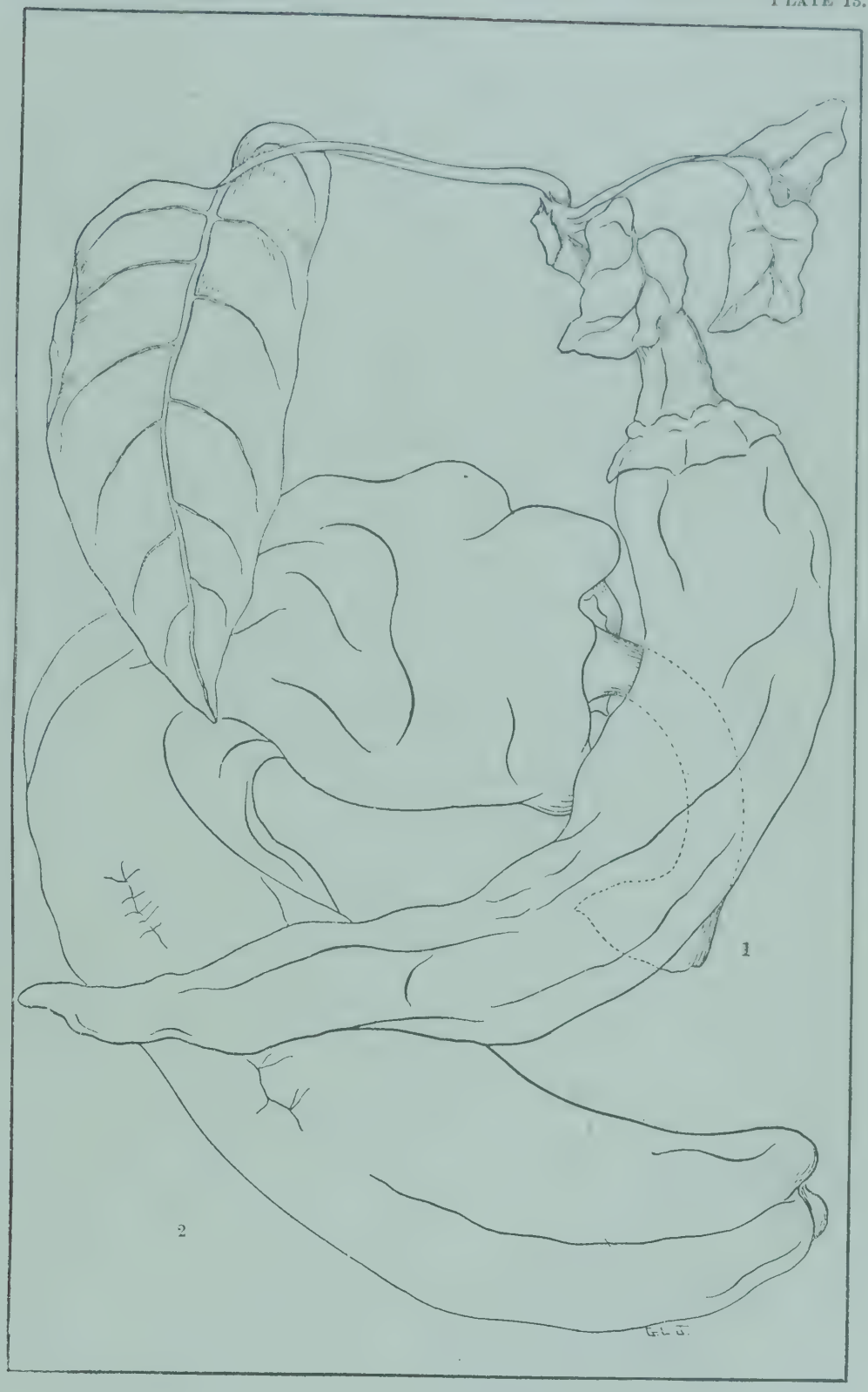
C. ANNUUM ACUMINATUM.



C. ANNUUM ACUMINATUM AND LONGUM.



C. ANNUUM ACUMINATUM AND LONGUM.



C. ANNUUM LONGUM.

1

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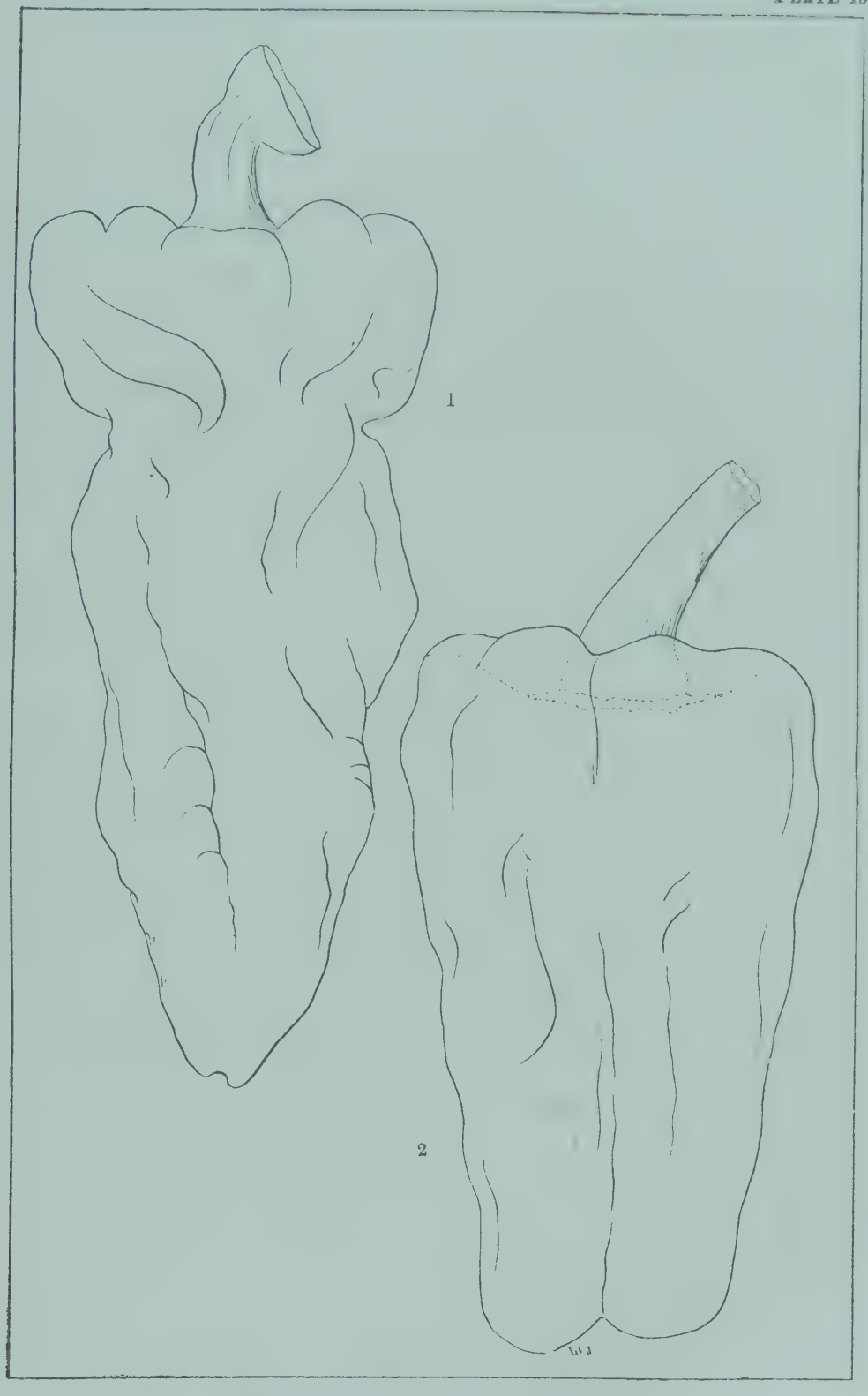
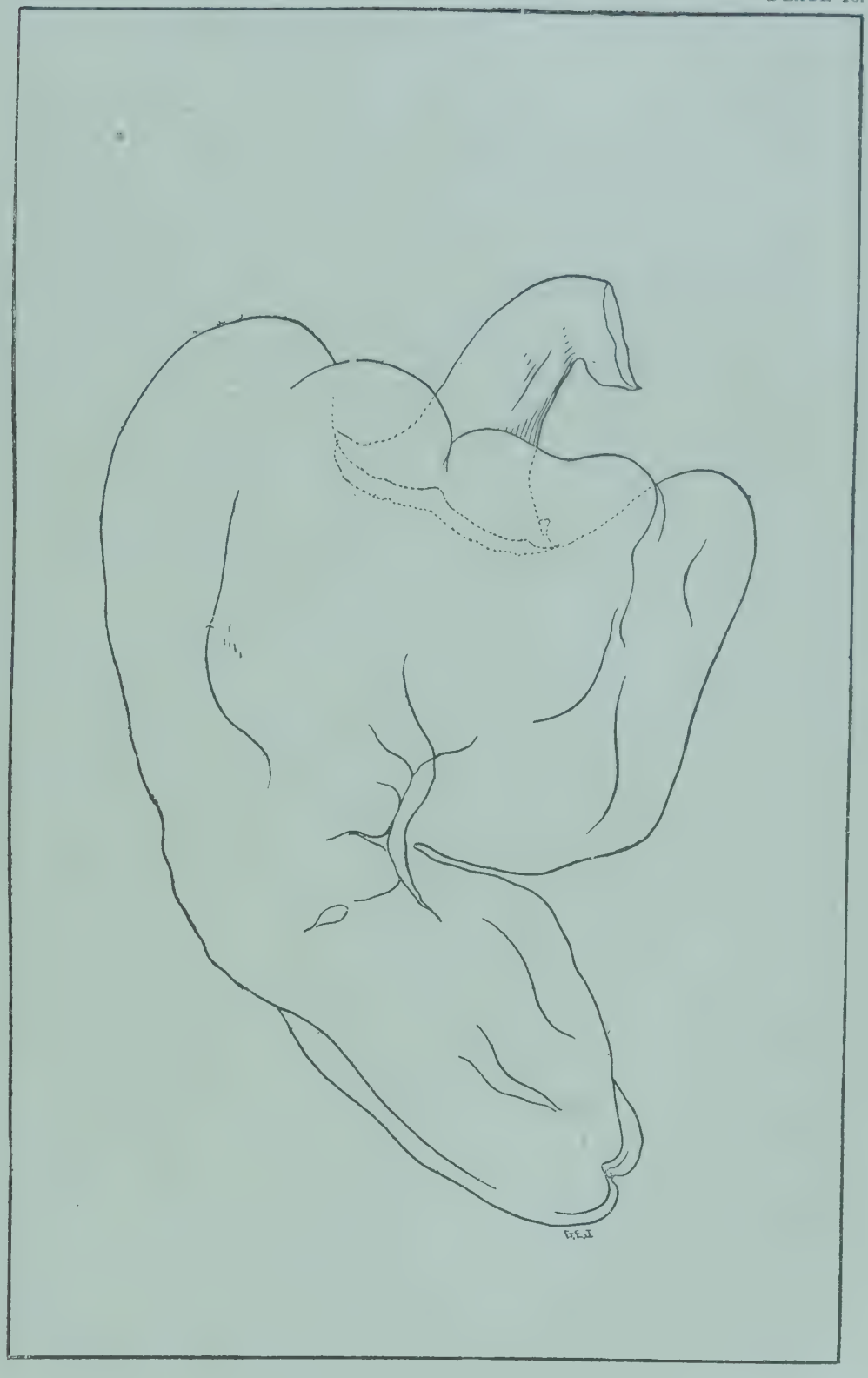
C. ANNUUM LONGUM.



C. ANNUUM LONGUM AND GROSSUM.



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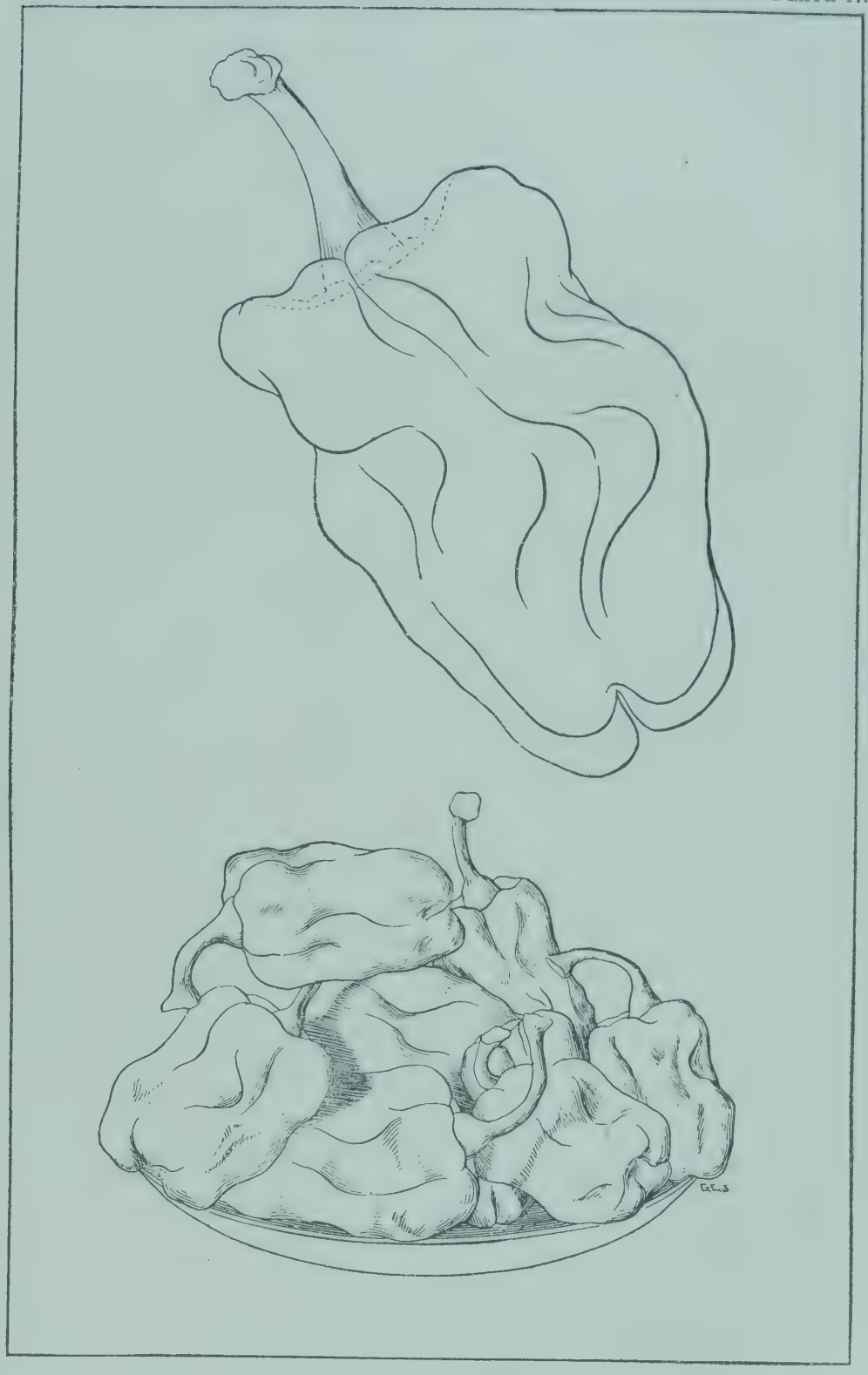

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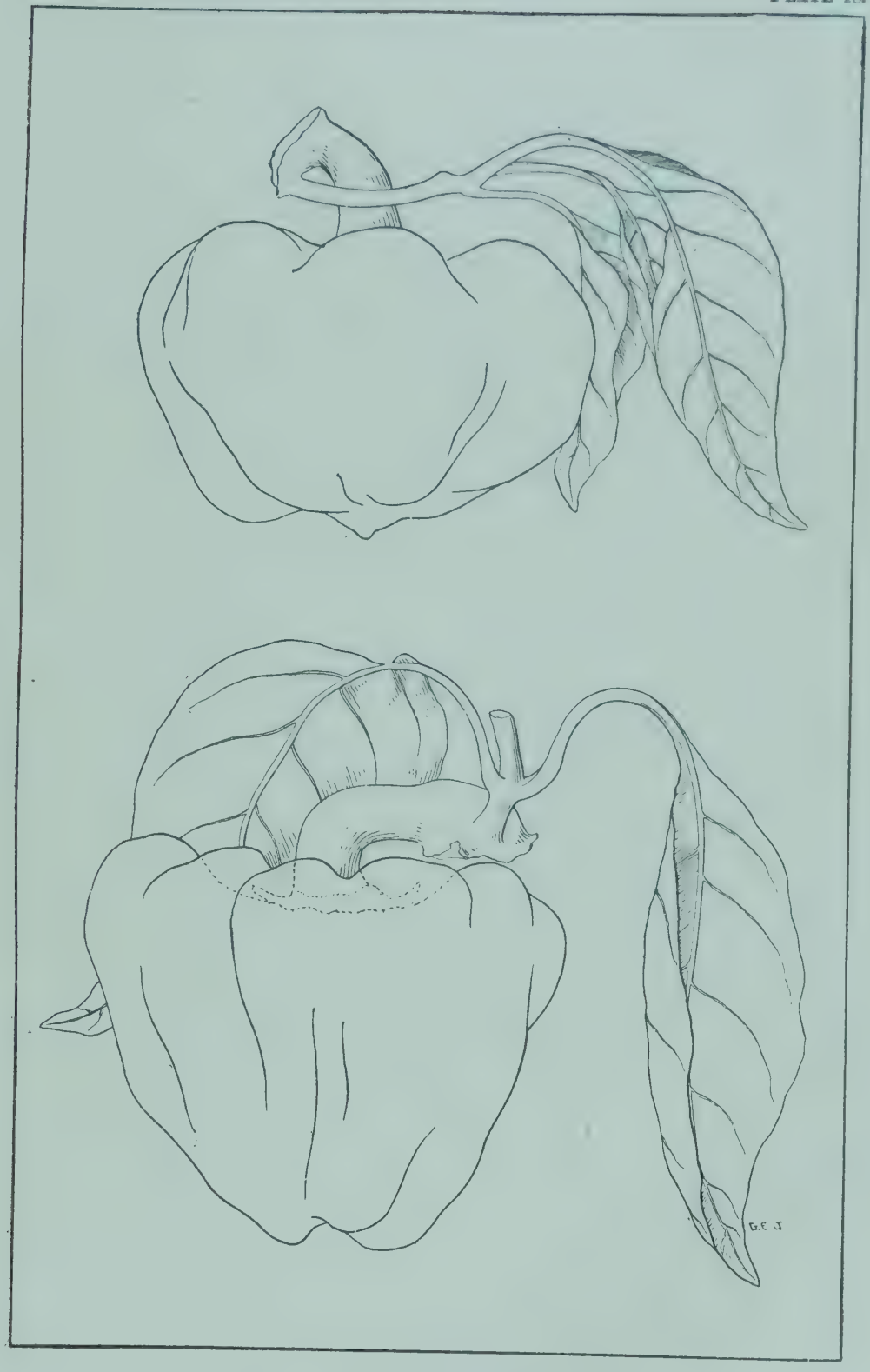

C. ANNUUM GROSSUM.

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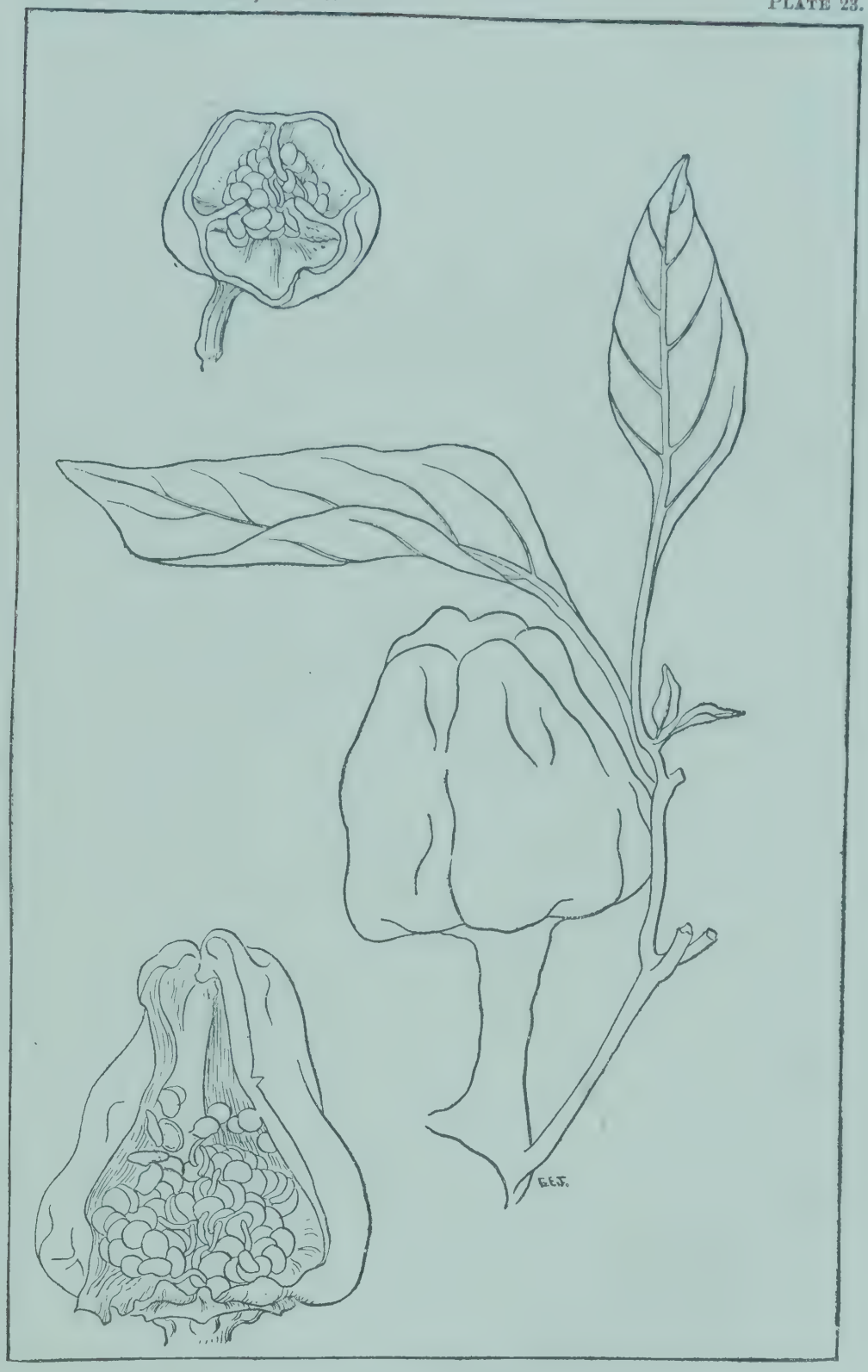

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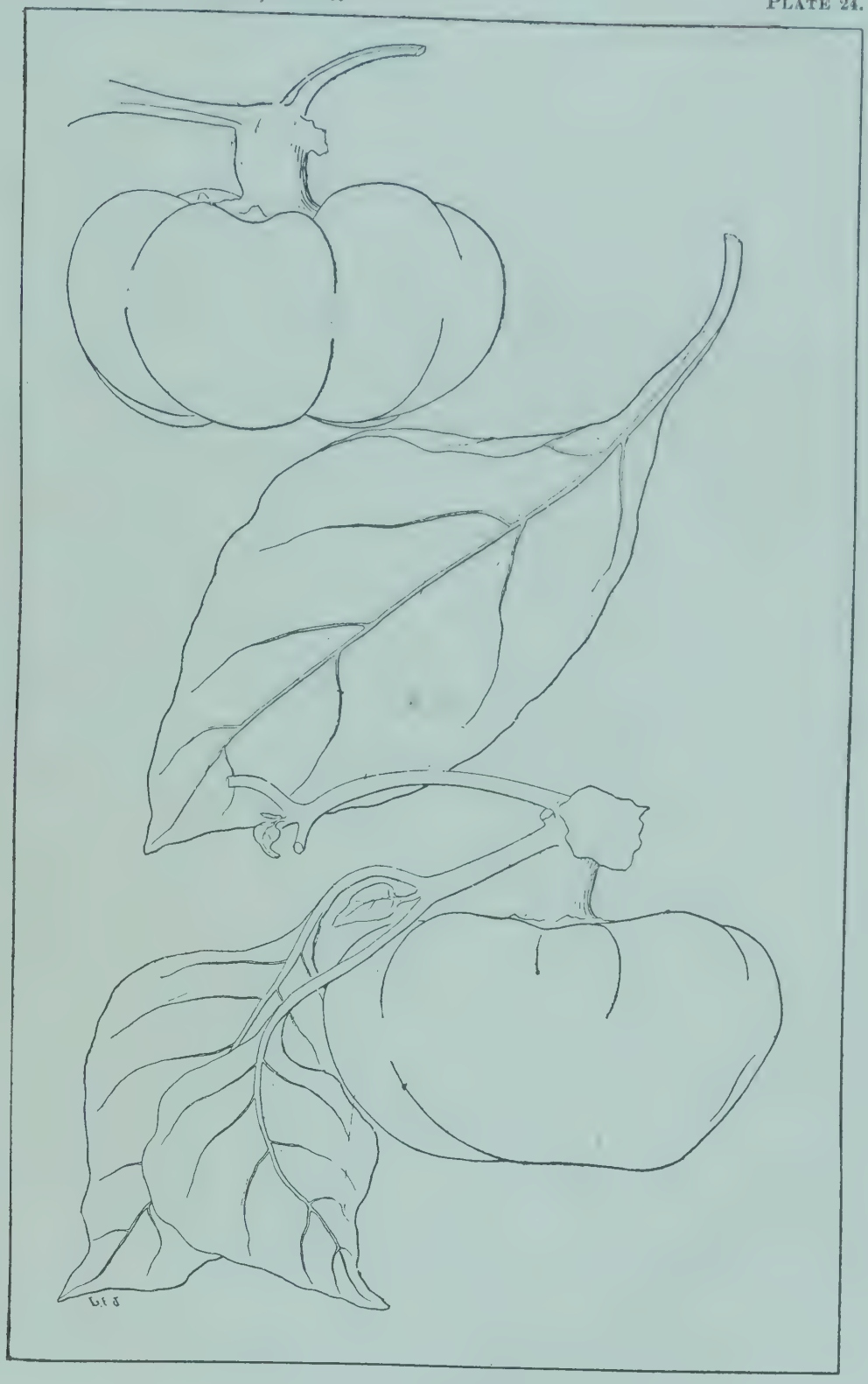

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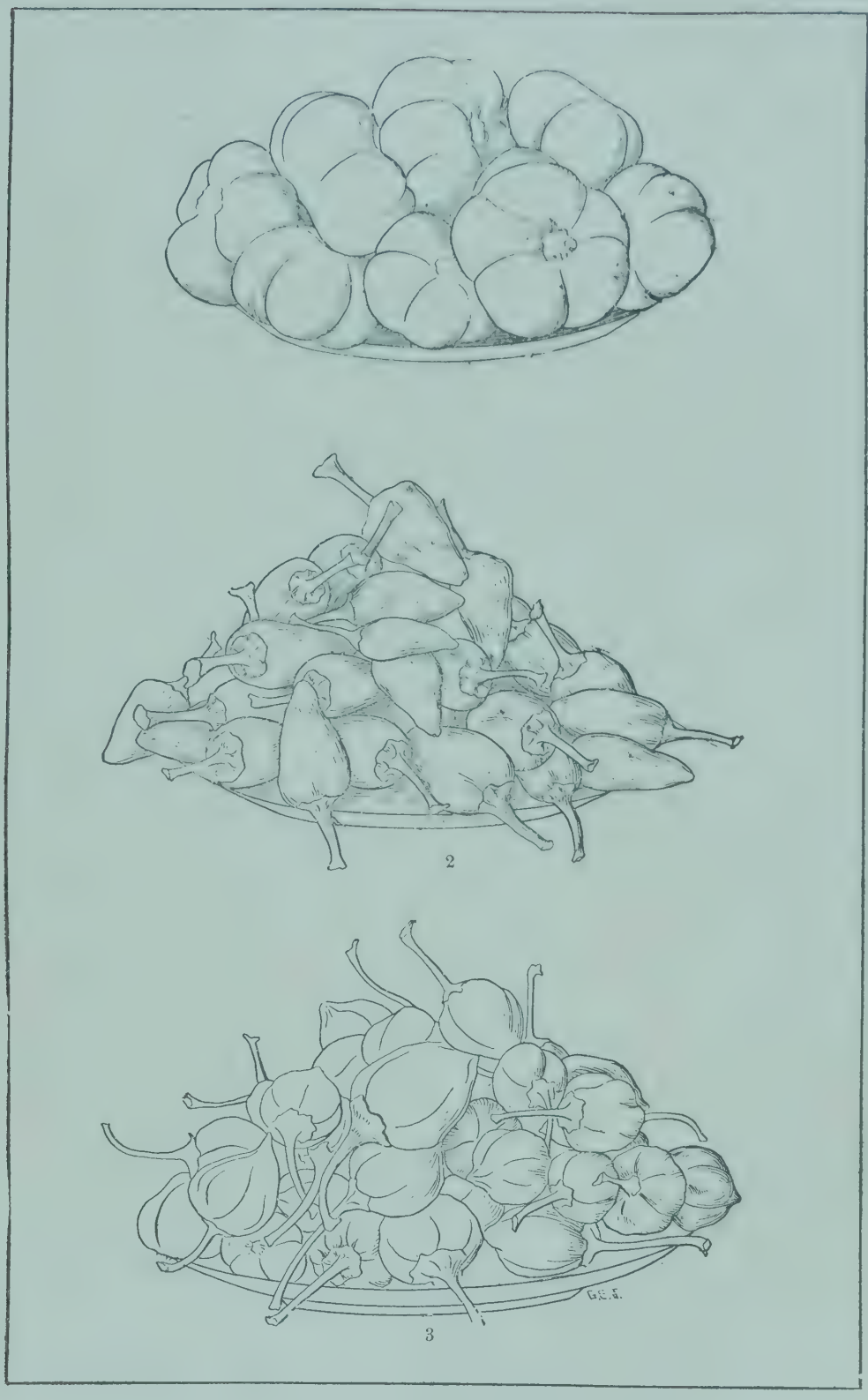
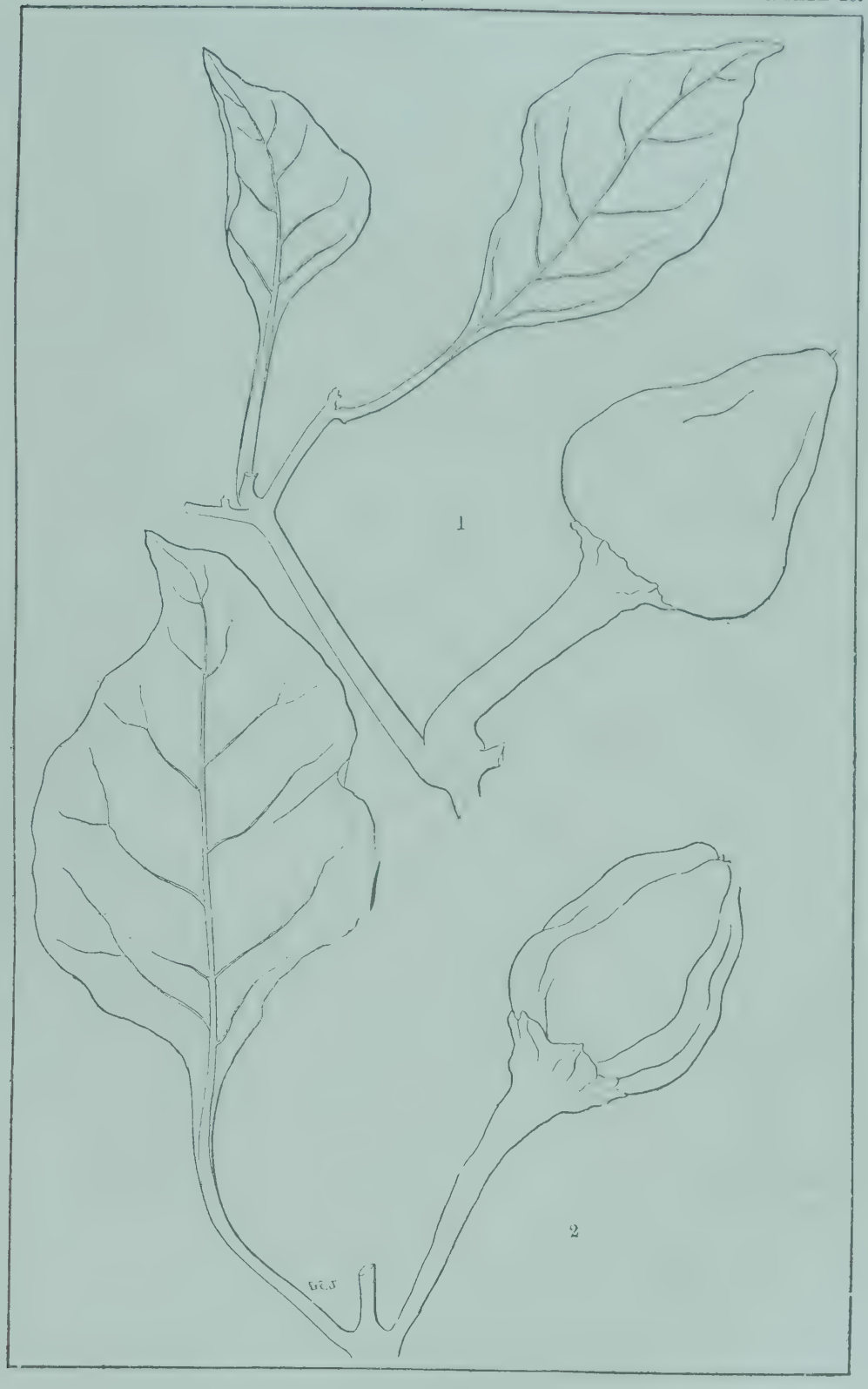
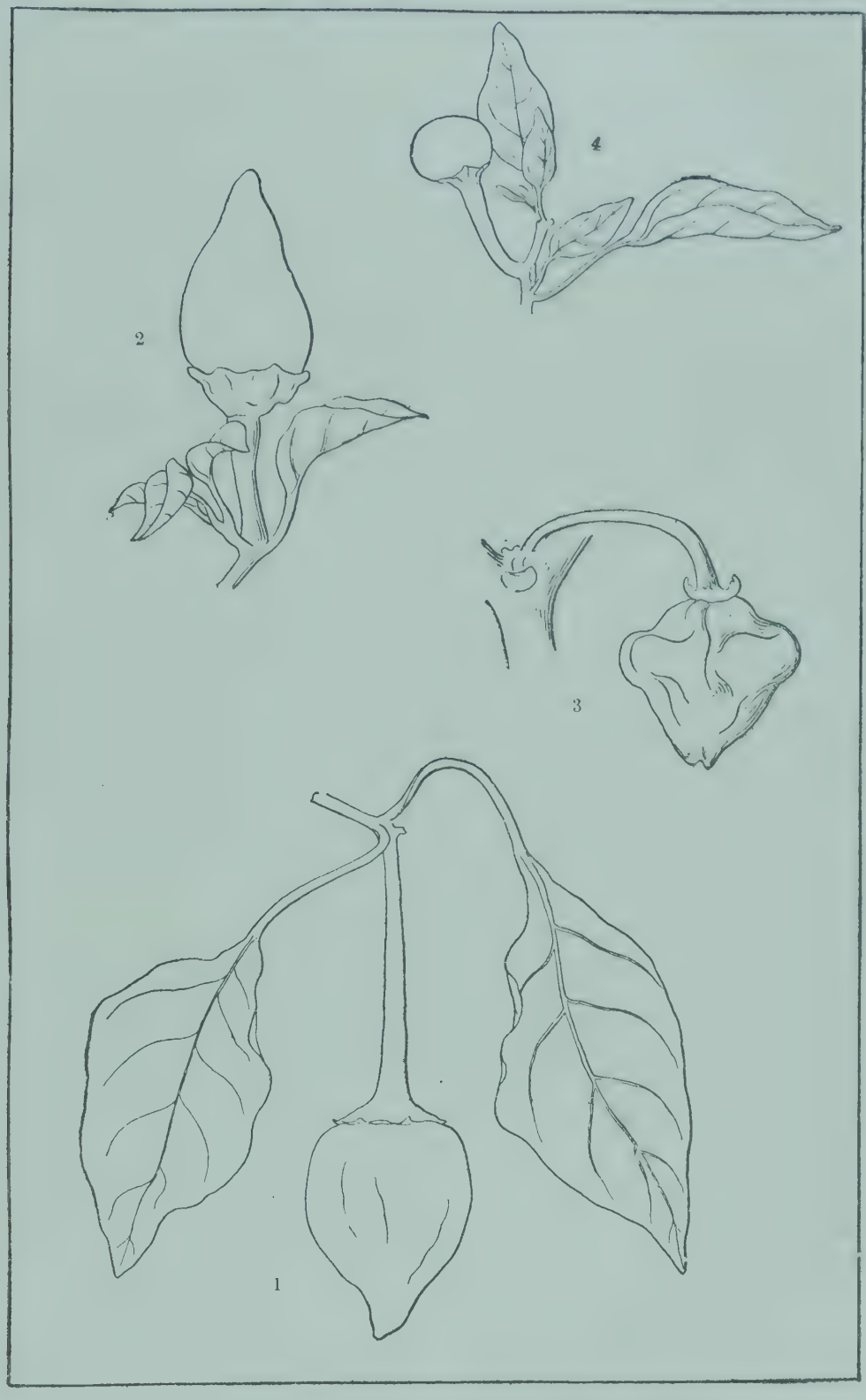


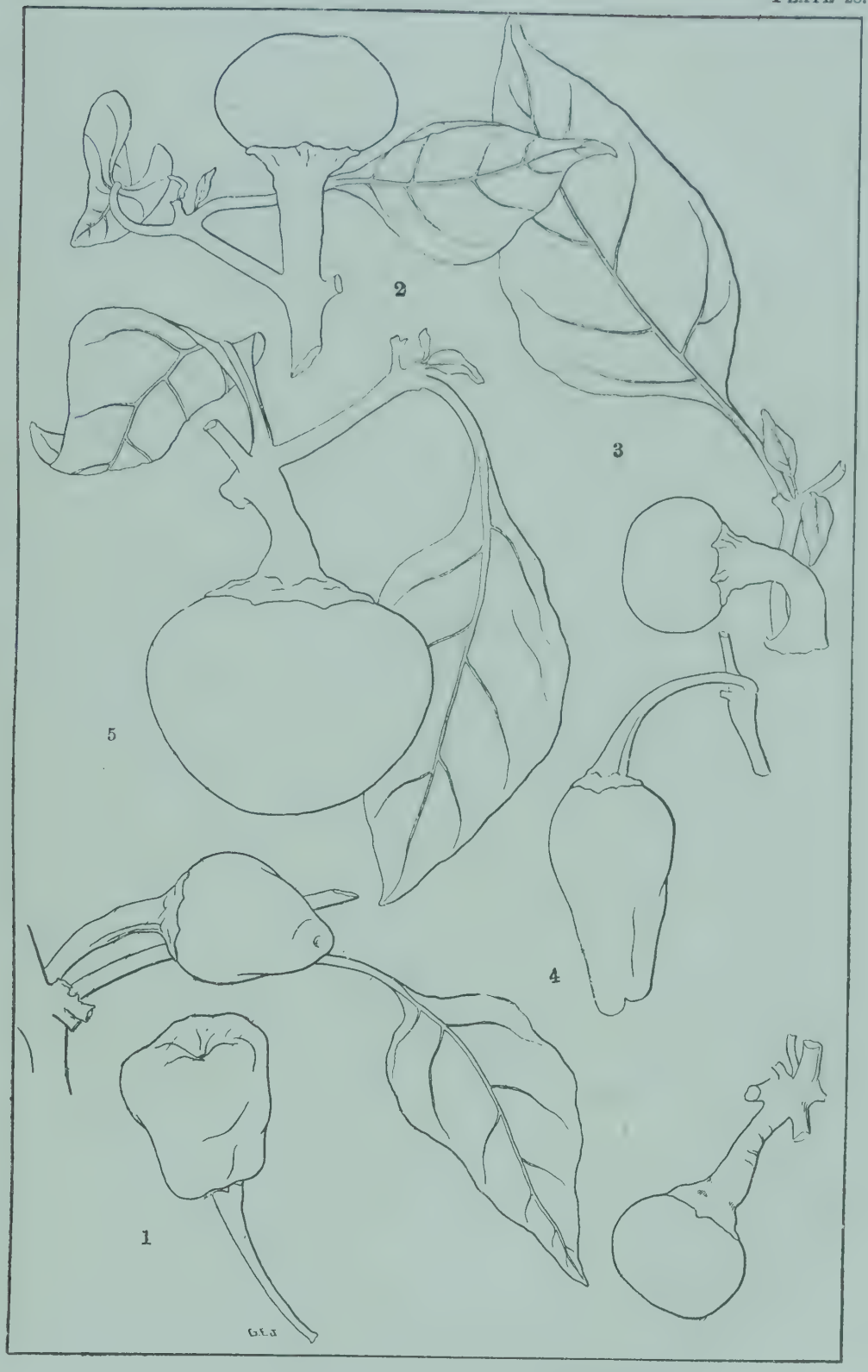
C. ANNUUM GROSSUM AND ABBREVIATUM.



C. ANNUUM ABBREVIATUM.



C. ANNUUM ABBREVIATUM AND CERASIFORME.



C. ANNUUM ABBREVIATUM AND CERASIFORME.

LIST OF CRYPTOGAMS COLLECTED IN THE BAHAMAS, JAMAICA AND GRAND CAYMAN.

BY ALBERT S. HITCHCOCK.

The flowering plants and ferns of this collection, made by me during the winter of 1890–91, for the Missouri Botanical Garden, were listed in the Fourth Report of the Garden,* to which the reader is referred for an account of the trip, the localities visited, and other necessary information. The cryptogams were collected incidentally, hence the list is meager in numbers, yet it seems of sufficient interest to present for publication. The specimens were all sent to specialists, whose reports are here brought together, and upon whom rests the responsibility for determination, citation and notes in each case.

LYCOPODINEAE.

(PROF. L. M. UNDERWOOD.)

LYCOPODIUM CERNUUM L. Sp. Pl. 1103. 1753.
Blue Mts. 1000–3500 ft.

LYCOPODIUM CLAVATUM L. Sp. Pl. 1101. 1753.
Blue Mt. Peak.

LYCOPODIUM COMPLANATUM L. Sp. Pl. 1104. 1753. Var.
Blue Mt. Peak.

SELAGINELLA PATULA (Swz.) Spring, Monogr. 2: 97. 1848.
Port Antonio.

SELAGINELLA SERPENS (Desv.) Spring, Monogr. 2: 102. 1848.
Port Antonio; Bog Walk; Lucea.

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* Rept. Mo. Bot. Gard. 4: 47–179. *pl. 11–14.*

HEPATICAE.

(PROF. L. M. UNDERWOOD.)

DUMORTIERA HIRSUTA (Swz.) R. B. N. Nova Acta Acad. Caes. **12**: 410. 1825.

Blue Mt. Peak.

MARCHANTIA CHENOPODA L. Sp. Pl. 1137. 1753.

Bog Walk; Port Antonio.

PALLAVICINIA LYELLII (Hook.) S. F. Gray, Nat. Arr. Br. Pl. **1**: 685, 775. 1821.

Blue Mt. Peak.

CALOBRYUM MNIOIDES (Gottsche) Schiffn. Nova Acta der Ksl. Leop. Carol. Deutschen Akad. der Naturf. **60**: 270. 1893.

Blue Mt. Peak.

CHARACEAE.

(DR. T. F. ALLEN.)

CHARA GYMNOPUS MICHAUXII A. Br.

Inagua.

ASCOLICHENES.

(PROF. T. A. WILLIAMS.)

RAMALINA USNEOIDES (Ach.) Fr. Lich. Eur. 1831. *Parmelia* Ach. Meth. Lich. 1803.

Grand Cayman.

RAMALINA USNEOIDES USNEOIDELLA Nyl. Recog. Ramal. 1870.

Grand Cayman.

RAMALINA DENTICULATA (Eschw.) Nyl. Recog. Ramal. 1870. *Parmelia* Eschw. in Mart. Fl. Bras. 1833.

Crooked Island.

USNEA BARBATA (L.) Ach.? Meth. Lich. 1803. *Lichen* L. Sp. Pl. 1753.

Grand Cayman?

Sterile. The plant has the aspect of certain forms of *U. barbata* looking toward *U. ceratina* but differs somewhat structurally as well as in various external characters.

PARMELIA PERLATA (L.) Ach. Meth. Lich. 1803. *Lichen* L. Syst. Nat. [ed. 12]. 1767.

Crooked Island.

This plant differs from the commoner forms of the species in the more abundant spermogones, somewhat wrinkled thallus and rather larger spores.

STICTA AURATA (Sm.) Ach. Meth. Lich. 1803. *Lichen* Sm. Eng. Bot.

Constant Springs.

STICTA WEIGELII (Ach.) Wainio, Lich. Bres. 1890. *S. damaecornis β. Weigelii* Ach. Lich. Univ. 1810. *S. quercizans* Tuckerm. Syn. N. A. Lich. 98. 1882.

Constant Springs.

Sterile and fragmentary, hence the determination is somewhat doubtful.

STICTA DAMAECORNIS (Sw.) Ach. Meth. Lich. 1803. *Lichen* Sw. Prod. Fl. Ind. 1788.

Blue Mt. Peak; Constant Springs.

The last named specimen is sterile and fragmentary and hence somewhat doubtful. That from Blue Mt. Peak is in fruit and gives spores which are fuscescent, or decolorate, quite persistently bilocular, but at length 4-locular, measuring 22–33 μ long by 6–8 wide.

STICTA SYLVATICA (L.) Ach. Meth. Lich. 1803. *Lichen* L. Sp. Pl. 1753.

Constant Springs.

STICTA FULIGINOSA (Dicks.) Ach. Meth. Lich. 1803. *Lichen* Dicks. Crypt. Fasc. 1785.

Constant Springs.

A single fragmentary specimen of a form with the under surface white and densely villous.

ERIODERMA WRIGHTII Tuckerm. Suppl. 1858

Constant Springs.

HEPPIA sp.

Fortune Island.

PANNARIA RUBIGINOSA (Thunb.) Delis. Dict. Class. Hist. Nat. 1828. *Lichen* Thunb. Prodr. Fl. Cap. 1794.

Constant Springs.

Sterile and fragmentary.

LEPTOGIUM TREMELLOIDES (L. fil.) Wainio, Lich. Bres. 1890. *Lichen* L. fil. Syst. Veg. Suppl. 1781. *Lichen azureus* Sw. Fl. Ind. Occ. 1806.— Fide Wainio l. c.

Port Antonio.

LECANORA FLAVOVIRENS SUBAERUGINOSA (Nyl.) Wainio, Lich. Bres. 1890. *L. granifera* var. *subaeruginosa* Nyl. Lich. Nov. Granat. 1863.

Port Antonio.

Growing on dead wood. Thallus whitish straw-colored, on a more or less distinct, bluish-black hypothallus. Spores slightly smaller than those described by Nylander, but the specimen is still rather immature.

THELOTREMA sp.

Fortune Island.

STEREOCAULON RAMULOSUM (Sw.) Ach. Meth. Lich. 1803. *Lichen* Sw. Prod. Fl. Ind. 1788.

Blue Mts.?

CLADONIA FIMBRIATA (L.) Fr. Lich. Eur. 1831. *Lichen* L. Sp. Pl. 1753.

Blue Mts.?

CLADONIA DACTYLOTA Tuckerm. Suppl. 2. 1859.

Blue Mts.

One of the specimens is near the var. *symphycarpia.*

CLADONIA RANGIFERINA (L.) Hoffm. Deutsch. Fl. 1795.— *Lichen* L. Sp. Pl. 1753.

Constant Springs.

CLADONIA DIDYMA MUSCIGENA (Eschw.?) Wainio, Mon. Clad. Univ. 1887. *Cladonia muscigena* Eschw.? in Mart. Flor. Bras. 1833.

Blue Mts.

CLADONIA DIDYMA VULCANICA (Zolling.) Wainio, Mon. Clad. Univ. 1887. *Cladonia vulcanica* Zolling. in Hasskarli Natur- et Geneeskundig Archief voor Neêrlands Indie. 1. 1847. — Fide Wainio, l. c.

Blue Mts?

The podetia are more densely squamulose than the type as described by Wainio, and the squamules are rather larger.

BUELLIA PARASEMA (Ach.) Th. Fr. Lich. Scand. 1874. *Lecidea* Ach. Lich. Univ. 1810. In part.

Fortune Island.

BUELLIA AERUGINASCENS (Nyl.) Tuckerm. in herb. *Lecidea disciformis* var. *aeruginascens* Nyl. Add. Fl. Chil. 1855.

With the preceding.

GRAPHIS TORTUOSA Ach. Syn. Lich. 1814.

Crooked Island.

Spores rather smaller than the average for this species.

TRYPETHELIUM CRUENTUM Mont. Ann. Sc. Nat., Bot. ii. 8. 1837.

Crooked Island.

TRYPETHELIUM MASTOIDEUM Ach. Lich. Univ. 1810.

Constant Springs.

The apothecia are scarcely typical but the specimens agree with this species otherwise.

TRYPETHELIUM ELEUTERIAE Spreng. Anl. z. Kenntn. Gewächs. 1804. *T. Sprengelii* Ach. Lich. Univ. 1810.

Crooked Island.

BASIDIOLICHENES.

(DR. W. G. FARLOW.)

DICHONEMA SERICEUM (Sw.) Mont.

Constant Springs.

BASIDIOMYCETES.

(DR. W. G. FARLOW.)

DIPLOCYSTIS WRIGHTII B. & C.

Inagua.

POLYSTICTUS SANGUINEUS (L.) Fr.

Inagua.

POLYSTICTUS MEMBRANACEUS (Sw.) Berk.

Port Antonio.

TRAMETES sp.

Inagua.

I do not see how this differs from *Trametes Pini* Fr.

TRAMETES FIMBRIOSA Fr.

Port Antonio.

PODAXON sp.

Port Royal.

UREDINEAE.

(MR. M. A. CARLETON.)

UROMYCES EUPHORBIAE Cooke & Peck, Rep. State Bot. N. Y. **25**: 90. 1873.

On leaves of *Euphorbia heterophylla* L. Fortune Island. Nov. 1890.

Only uredospores present in these specimens.

PUCCINIA LATERIPES Berk. & Rav. Grevillea **3**: 52. 1874.

On leaves of *Ruellia clandestina* L. Streets of Kingston. Dec. 9, 1890.

PUCCINIA GILBERTII Spegazz. Ann. Soc. Cient. Argent. **10**: 8. 1880.

On leaves of *Hyptis suaveolens* (L.) Poit. Constant Springs, Jamaica. Dec. 10, 1890.

Only uredospores present in this collection.

PUCCINIA EMACULATA Schwein. Trans. Amer. Phil. Soc. **4**: 295. 1831.

On leaves of *Panicum brevifolium* L. Port Antonio, Jamaica. Dec. 1890.

PUCCINIA HETEROSPORA Berk. & Curt. Journ. Linn. Soc. **10**: 356. 1869.

On leaves of *Abutilon crispum* (L.) Don. Fortune Isl. 1890.

Mesospores greatly predominate.

PUCCINIA ARECHAVALETAE Spegazz. Ann. Soc. Cient. Argent. **11**: 22. 1881.

On leaves of *Cardiospermum Halicacabum* L. Lucea, Jamaica. Jan. 1891.

The author says, concerning this species, in the description above cited: "Species sporis valde ludentibus, et inter *Uromycetem* et *Pucciniam* nutans, ac vere inter duo genera intermedia." The specimens of this collection show a great majority of mesospores (?). But it is a question whether these should really be called mesospores, and whether the species may not be a *Uromyces* rather than a *Puccinia*. At times the same question would seem to apply almost equally as well, also, to the above species, *P. heterospora*. It is simply another instance among many, showing the uncertainty of purely morphological characters, alone, as a basis of classification.

PUCCINIA SPERMACOCIS Berk. & Curt. Grevillea **3**: 53. 1874.

On leaves of *Spermacoce aspera* Aubl. Lucea, Jamaica, Jan. 3, 1891. On *Ernodia littoralis* Sw. Nassau. Nov. 9, 1890.

PUCCINIA XANTHII Schwein. Trans. Amer. Phil. Soc. **4**: 296. 1831.

On leaves of *Struchium Sparganophorum* (L.) OK. Streets of Kingston. Dec. 9, 1890.

PUCCINIA LANTANAE Farl. Proc. Amer. Acad. Arts & Sci. **18** (n. s. **10**): 83. 1883.

On leaves of *Abena Jamaicensis* (L.) Hitchc. Nassau, Bahamas. Nov. 9, 1890.

A comparison with type specimens, kindly sent me by Dr. Farlow, shows only a slight difference in the appearance of the sori, with a less number of mesospores in Prof. Hitchcock's specimens.

AECIDIUM CESTRI Mont. Ann. Sci. Nat. ii. **3**: 356. 1835.

On leaves of *Solanum torvum* Sw. Port Morant, Jamaica. Dec. 20, 1890.

This may be a new species, but the description of Montagne's species applies so well to these specimens, that I deem it safest, in the absence of type specimens for comparison, to use his name. The species is especially interesting in exhibiting such highly sculptured imbricated pseudoperidial cells.

AECIDIUM CISSI Wint. Hedwigia **23**: 168. 1884.

On leaves of *Cissus sicyoides* L. Port Morant, Jamaica. Dec. 20, 1890.

It is a matter of some interest to note the number of the above species of *Uredineae* that are of South American range.

USTILAGINEAE.

(DR. P. MAGNUS.)

MYKOSYRINX CISSI G. Beck. Ann. Hofmus. Wien. **9**: 123. 1894.

On *Cissus sicyoides* L. Port Morant.

PYRENOMYCETES.

(MR. J. B. ELLIS.)

PERISPORIUM WRIGHTII B. & C.

On *Opuntia Tuna* (L.) Mill. Inagua.

PHYLLACHORA OXALINA. E. & E. N. A. P. 602

On *Oxalis corniculata* L. Nassau.

PARODIELLA GRAMMODES (Kze.) Cke.

On *Crotalaria retusa* L. Lucea.

CERCOSPORA MELOCHIAE Carleton in litt.

On *Melochia tomentosa* L. Eleuthera.

MELIOLA SIMILLIMA E. & E. n. sp.

On *Echites Brownei* J. Müll. Nassau. Dec. 1890.

Mycelium branched, radiating, forming patches 2-4 mm. diam. or larger by confluence. Threads about 5 μ diam. with alternate hyphopodia. Capitate hyphopodia narrowed below, ovate, faintly uniseptate, 15 $\times$ 8–10 μ. Mucronate hyphopodia flask-shaped, about 15 $\times$ 6–7 μ, paler brown. Bristles arising from the mycelium, simple, straight or a little curved, 150–200 $\times$ 5–6 μ, septate, soon opake. Perithecia globose, rough, 100–115 μ diam. Asci ovate, 30 $\times$ 20 μ, 2-spored; paraphyses none. Sporidia cylindrical, obtuse and rounded at the ends, 4-septate and slightly constricted at the septa, 24–28 $\times$ 10–12 μ.

This comes near *M. microspora* Pat. and Guill., but that has stouter bristles, coarser subcrustose mycelium and smaller sporidia, and is found on a different order of plants.

SPHAERELLA RAJANIAE E. & E. n. sp.

On leaves of *Rajania hastata* L. Nassau. Nov. 1890.

Perithecia hypophyllous, gregarious in small groups, not on very decided spots, about $\frac{1}{4}$ mm. diam., subcuticular, black, subcollapsing, the minute, papilliform ostiolum barely piercing the blackened epidermis. Asci oblong-cylindrical, sessile, 60–65 $\times$ 8–10 μ, obscurely paraphysate, 8-spored. Sporidia biseriate, oblong-fusoid, hyaline, faintly uniseptate, 18–20 $\times$ 4–5 μ.

PHYLLOSTICTA COCCOLOBAE E. & E. n. sp.

On leaves of *Coccoloba uvifera* (L.) Jacq. Nassau. Nov. 1890.

Spots amphigenous, orbicular, 3–5 mm. diam., purplish-red, with a slightly raised, darker colored border, outside of which is a narrow, paler, shaded margin, bordered with an appressed, coarse, light colored fringe. Perithecia innate, mostly hypophyllous, minute, invisible without a lens. Sporules narrow-elliptical, or subfusoid, hyaline, 5–6 $\times$ 2$\frac{1}{2}$ μ.

SEPTORIA sp.

On *Plumeria obtusa* L. Crooked Island. Nov. 1890.

Spots orbicular, zonate, light brown, 3–6 mm. diam., with a narrow slightly raised border. Perithecia scattered on the spots, epiphyllous, innate with the apex prominent, small, 100–120 μ diam. Sporules strongly curved, continuous, nucleolate, 12–20 $\times$ 1–1½ μ.

RAMULARIA BAUHINIAE E. & E. n. sp.

On leaves of *Bauhinia divaricata* L. Port Morant, Jamaica. Dec. 1890.

Mycelium forming thin, white, scattered, indefinitely limited patches on the under side of the leaf. Fertile hyphae cespitose, hyaline, 15–25 $\times$ 3 μ, roughened, and often toothed above, with the apex mostly truncate. Conidia fusoid, continuous or uniseptate, 12–15 $\times$ 2½–3 μ.

RAMULARIA TORVI E. & E. n. sp.

On leaves of *Solanum torvum* Sw. Port Morant, Jamaica. Dec. 1890.

Hypophyllous, with an olivaceous mycelium, forming definite, subconfluent dark-colored patches, giving the leaf a mottled and clouded appearance, but without any spots, except that the upper surface of the leaf opposite becomes yellowish brown. Fertile hyphae branched, 15–35 $\times$ 3 μ, smoky-hyaline, somewhat roughened or distinctly toothed above, continuous. Conidia terminal or lateral, ovate, continuous, 5–7 $\times$ 2–2½ μ, smoky-hyaline.

Varies from typical *Ramularia* in its dark-colored mycelium, which gives it the aspect of *Cercospora*.

CERCOSPORA PIPERIS E. & E. n. sp.

On leaves of *Piper hispidum* Sw. Port Morant, Jamaica. Dec. 1890.

Hypophyllous, forming suborbicular, dark-colored patches 3–5 mm. across, not on any spots, though the upper surface of the leaf, opposite the patches below, is blotched with dark-colored, indefinite spots. Hyphae cespitose, olivaceous, continuous or faintly septate, 35–40 $\times$ 4–5 μ, spreading and subundulate, but not strongly toothed or bent above. Conidia faintly brownish, cylindrical, nucleate, becoming faintly 3- or more-septate, 35–60 $\times$ 3 μ.

CERCOSPORA TURNERAE E. & E. n. sp.

On leaves of *Turnera ulmifolia* L. Nassau.

Spots epiphyllous, whitish, indefinite; border brown. Hyphae hypophyllous, tufts effused, forming subindefinite patches 3–4 mm. across, the part of the leaf occupied by the fungus a little paler, but there are no definite spots. Hyphae tufted, brown, undulate, faintly nucleate, continuous or sparingly septate, 60–90 $\times$ 4 μ. Conidia slender, brownish, faintly 1–3-septate, straight, attenuated above or the shorter ones cylindrical, 60–90 $\times$ 3–4 μ.

CERCOSPORA STACHYTARPHETAE E. & E. n. sp.

On leaves of *Stachytarpheta Jamaicensis* Vahl. Nassau. Nov. 1890.

Spots small, scattered, round, white, with a dark margin, 1–2 mm. diam. Hyphae epiphyllous, cespitose, 40–60 × 4 μ, pale brown, spreading, undulate, and subgeniculate above, continuous, not effused. Conidia cylindrical, smoky-hyaline, obtuse, 5–9-septate, 50–65 × 4–5 μ.

CERCOSPORA CALOTROPIDIS E. & E. n. sp.

On *Calotropis procera* (Ait.) R. Br. Fortune Island. Nov. 1890.

Spots ½–1 cm. diam., dirty brown, with the margin darker. Hyphae not abundant, tufted or spreading, pale, continuous, 15–30 × 3 μ, subundulate and nearly entire. Conidia cylindrical, yellowish-hyaline, 30–40 × 3 μ, nearly straight. The tufts of hyphae are thickly scattered over the spots on both sides of the leaf, and are very minute so as to be seen with difficulty without the lens.

PERONOSPORACEAE.

(MR. J. B. ELLIS.)

CYSTOPUS CANDIDUS (Pers.) Lev.

On a mustard (*Cakile maritima* Scop?). Nassau.

CYSTOPUS CONVOLVULACEARUM Speg.

On *Ipomoea Pes-caprae* (L.) Sweet. Grand Cayman.

AGAVE WASHINGTONENSIS AND OTHER AGAVES FLOWERING IN THE WASHINGTON BOTANIC GARDEN IN 1897.

BY J. N. ROSE.

The Botanic Garden at Washington contains a large and valuable collection of agaves. This is said to compare favorably with the choice collection at the Kew Gardens, though the number of species is perhaps smaller. Unfortunately the collection has never been critically studied. After a somewhat casual examination of a number of the plants, it seems to me that there must be several undescribed species, or else some of them vary considerably from published descriptions. Mr. William R. Smith, the Director of the Garden, has long been collecting these plants as well as caring for those sent in by various government collectors. During the winter of 1897 five species flowered and were identified by me. This, at first, seems a small number, yet when we remember that only twenty-five species have flowered at Kew during the last fifteen years, it is seen to be a very fair percentage. One of these (*A. Washingtonensis*) appears to be undescribed. Two (*A. albicans* and *A. Sartorii*) are among the more common species, and two (*A. attenuata* and *A. potatorum*) are rarely seen in flower.

Agave Washingtonensis Baker & Rose sp. nov.

In January, 1897, an agave labeled *A. Ghiesbreghtii* flowered for us. I soon saw that it did not belong to that species, nor was I able after careful study to place it with any described species. Specimens were submitted to Mr. J. G. Baker of Kew, who reported that he could not match it and that it was probably new. After further study it was decided to describe and publish it as new. Since the history of the plant has been lost and its habitat is unknown,

the specific name *Washingtonensis* has been adopted. The leaves form a dense rosette and are of a dark green color. The spike was fully 5 feet long and somewhat curved. Although belonging to the Littaea section, the flowers are borne in clusters of three to six. They are greenish with purplish margins to the segments. During the summer the plant was put out in the grounds and received little or no attention. A few capsules matured and seeds have been sent to Kew and the Missouri Botanical Garden, and some have been planted here. It is hoped that enough plants will thus be raised to supply all collectors of this genus. In September a few bulblets were produced on the old flower stalk. Although the plant was supposed to be dying, it was taken into the greenhouse for the winter and in January, 1898, sent out an axillary bud. The species is therefore polycarpic. It may be technically described as follows: —

Acaulescent; leaves numerous (20 to 25), forming a dense rosette, spatulate-oblong, 2½ feet long, 3 to 4 inches wide near the middle, tapering to two inches at base, dark green, hardly glaucous, not banded, margined throughout with a brown horny edge furnished with small irregular deltoid, sometimes hooked teeth 1 to 2 lines long; end spine short and pungent; peduncle 2 feet long, more or less covered with long acuminate brownish bracts; spike about 5 feet long, more or less curved; bracts often subtending 3 to 6 flowers; ovary 9 lines long; perianth tube very short or wanting; segments oblong, 10 lines long, 3 lines broad, greenish, the margins purplish, obtuse; stamens under 2 inches long; style longer than the stamens.

It belongs to Mr. J. G. Baker's group Rigidae. Probably a native of Mexico.

Agave albicans.

A plant of this species flowered here in 1896 and another began to flower May 1, 1897. Both of these are choice plants. Although this species may be classed among the smaller agaves yet it is a showy one. It has a comparatively short pole, but the flowers are large, in a rather dense cluster. The foliage is quite handsome, being of a

pale glaucous green and composed of a dense rosette of leaves. Mr. Baker in his Handbook of Amaryllideae states that the segments of the flower are greenish-yellow, but later he says, in the Botanical Magazine, that they are "green outside, brown inside." In our specimens the upper half of the segments is brown outside and on the inside they are brown throughout. This species has flowered but once at Kew and twice in our gardens. The following are the only instances with date of flowering of which I have knowledge: (1) In the Belgium Garden, Count d'Osselghem, 1867. (2) At Blueberry, Mr. Justus Corderoy, 1887. (3) At Kew in 1891. (4) In the Botanic Garden at Washington, Mr. Smith, 1896. (5) In the Botanic Garden at Washington, Mr. Smith, 1897.

The flowers much resemble in color and shape those of *A. Haseloffii*. The stamens mature several days before the style. In our specimen the spike was nearly three weeks in developing all its flowers. Mr. Watson in speaking of the Kew plant says it lived after flowering, developing two lateral growths. I have observed these lateral growths in both of our specimens.

The plant which flowered in 1897 has four strong buds, while the other one has eight lateral buds. The species is, therefore, as Mr. Watson has shown, polycarpic.

Our specimens may be described as follows: —

Acaulescent; leaves about 30 in a dense cluster, 15 inches long, oblanceolate, 3 to 3½ inches broad above the middle, tapering above into a weak black spine less than one inch long, the margin with small black teeth, pale and glaucous on both sides; peduncle stiff, nearly erect, 2½ feet long, clothed with long attenuate green bracts; spike 15 inches long, rather dense-flowered; flowers including ovary 1¼ to 1½ inches long, including the stamens 3 inches; style developing several days after the stamens; segments of flower thick, ovate, purplish within and at the tip without.

Agave Sartorii.

A. Sartorii is a native of Mexico and Guatemala and was introduced into cultivation about 1863. It has flowered at Kew, first in 1877, and frequently since. The specimen at

Kew, according to Mr. W. Watson, has flowered eleven times and now has a stem five feet high. We have the species in the Botanic Garden under the names both of *A. Sartorii* and *A. Noackii*. The one bearing the latter name has a clearly marked band down the center of the leaves while in the other plant the leaves are scarcely if at all banded. The specimen marked *A. Sartorii* has long been growing in the Botanic Garden and flowered for the first time in February and March, 1897. The plant is said to be 15 years old. It differs from the description of *A. Sartorii* in its narrower hardly banded leaves, shorter spike, and smaller flowers. A good habit sketch and detail drawing is to be found in the Botanical Magazine, t. 6292 (1877).

This is said to be the only species known which develops its inflorescence from lateral buds. The specimen in the Botanic Garden which recently flowered, is now sending out two new shoots. It may be described as follows:—

Stem 1 foot high, clothed with old leaves; leaves 15 to 20, 2 feet long, 1 to 1⅓ inches broad near the middle, slightly narrowed toward the broad (3 in.) and thick (1 inch) base; end spine weak; margin with minute brown teeth; peduncle 2½ feet long, glaucescent, bracteate, strongly curved at top; bracts resembling those of *A. attenuata*, the lower ones 4 inches long, serrulate, pale green and long-attenuate; spike a foot long, each bract subtending 2 flowers; flowers very small; ovary 4 lines long; tube of perianth 3 lines long, lobes 4 to 5 lines long, greenish-yellow; stamens and style twice as long as perianth; filaments inserted near the top of the tube.

Agave attenuata.

A magnificent specimen of this stately agave bloomed at the Washington Garden early in 1897. This is the first time the species has flowered here, and so far as I can learn the first time also in this country. The plant was bought in Such's Nursery by Mr. Smith more than twenty years ago. The plant was nearly two months in developing its spike and was in bloom nearly three months. Only a few capsules set seed, and the plant has since died.

This species never produces but a single flowering spike and is therefore monocarpic. It sends off many little

suckers from near the base of the stem, which either break off or may be removed and transplanted. I have so far seen no bulbs developing in the inflorescence as sometimes occurs in certain other species.

The previous history of our plant is unknown, but it undoubtedly came from Mexico, the home of the species. It differs from all the figures and descriptions in having a perfectly straight pole or spike of flowers instead of a curved one. In all other respects the plant differs little from the descriptions of *A. attenuata*.

In our specimen the woody stem below the crown of leaves is four feet high and one foot in circumference at thickest point, which is a short distance below the crown. It is marked with quadrangular scars, three to four inches wide by one inch deep. The crown is truly a noble sight, consisting as it does of twenty or more immense leaves and measuring nearly six feet in diameter. The leaves are at first erect, but when mature they are spreading and in age drooping, the lower ones gradually falling off, leaving the peculiar scars referred to above. The larger are from two and a half to three feet long, from six to eight inches broad at the widest point, which is about two-thirds of the distance from the base, gradually tapering to near the base, where they are three or four inches wide, while they rapidly taper upward into long weak spines. All are very glaucous on both sides, while the margin is entire and thin, at first whitish, but in age brownish. During the flowering period the larger leaves drop off, leaving only ten to twelve, which are not more than two inches in width and two feet long. The peduncle is only about one foot long, and is very thickly covered with large leaf-like bracts, somewhat appressed, but spreading at the base, and acuminate. The flowering spike is very dense and fully five feet long; the flowers are in pairs subtended by bracts; these bracts are green, attenuate, horizontal, the lower ones being five inches long. The flowers are mostly sterile, the perianth tube very short, the stamens much longer than the petals.

The species was first described by Salm Dyck in 1834. It was afterward (1862) described by Sir William Hooker as *Agave glaucescens* in the Botanical Magazine, and is sometimes found in cultivation as *A. spectabilis*. It has been several times illustrated as will be seen from the references appended.*

The plant was introduced into cultivation about 1834. It flowered first at Kew in 1861, and has flowered several times since. It has been widely distributed in gardens, and will doubtless be frequently found flowering in the future.

The above account was published in part in Garden and Forest for 1897.

Agave potatorum.

Our specimen bloomed in June after I had left the city for the summer and, therefore, the flowers were not examined. The leaves correspond fairly well with the description. This is the only time this species has flowered here. It flowered at Kew in 1894 and in Paris about 1875.

Our plant was still alive February 1, 1898, but it is gradually dying and the species is doubtless monocarpic, as has been noted by Watson.

The leaves were 2 to $2\frac{1}{2}$ feet long at the widest point. The peduncle was 6 feet long excluding the inflorescence, which was only $1\frac{1}{2}$ feet long with very short branches.

EXPLANATION OF PLATES OF AGAVE.

Plate 29. *Agave Washingtonensis*,— habit, reduced.

Plate 30. *Agave Washingtonensis*,— a, Leaf, $\frac{2}{3}$ natural size,— b, c, sections of same, natural size,— d, flower, natural size.

Plate 31. *Agave attenuata*,— habit, reduced.

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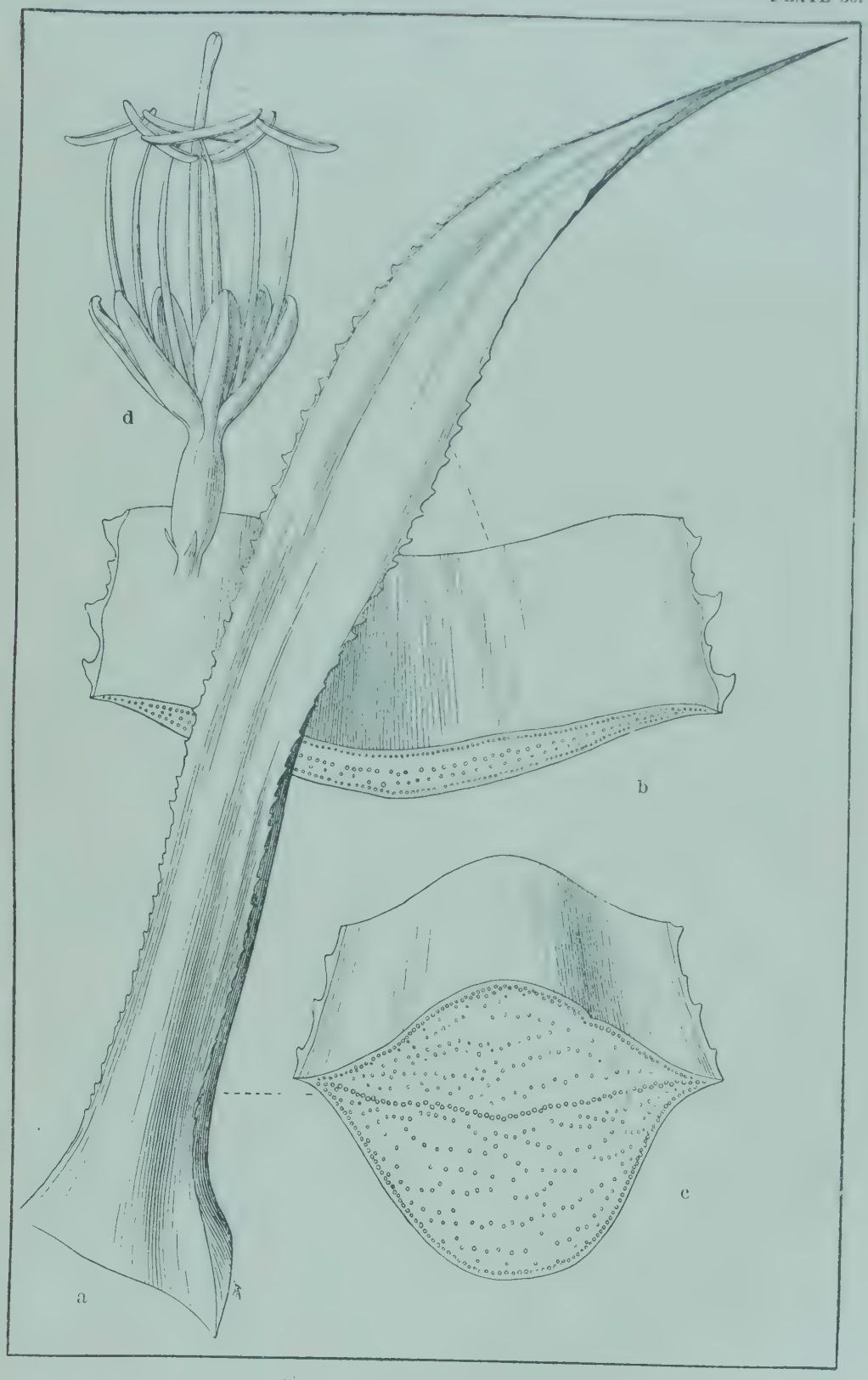
* The most important references are the following: *Agave attenuata* Salm Dyck, Hort. Dyck. 303. 1834. — Rev. Hort. 1875: 149. *f. 31, 32.*— Gard. Chron. ii. **8**: 748. 1877.— Garden and Forest **10**: 95. 1897.

Agave glaucescens Hook. Bot. Mag. **88**: *t. 5333*. 1862.— Gard. Chron. ii. **2**: 219. *f. 53, 55.* 1887; iii. **8**: 560. 1890; iii. **17**: 457. *f. 63, 64.* 1895.

AGAVE WASHINGTONENSIS.



AGAVE WASHINGTONENSIS.

AGAVE ATTENUATA.

THE SPECIES OF CACTI COMMONLY CULTIVATED UNDER THE GENERIC NAME ANHALONIUM.

BY CHARLES HENRY THOMPSON.

Diversities of opinion are so prevalent as to just what plants should be included in this group, as well as to the validity of a generic separation of the two forms from Mamillaria and Echinocactus respectively, that naturally much confusion has arisen. The object of this paper is not so much an attempt at a monograph as it is to bring together the literature of the various species, with illustrations of each, photographed from living plants, and in addition to give such notes as I have taken in my observations and studies of the plants grown in the Missouri Botanical Garden.

I shall treat the group as being made up of two distinct genera, in that respect following Coulter's revision of the order.

ANALYTICAL KEY.

I. Tubercles evident, the exposed surface triangular in outline; the epidermis cartilaginous in texture. ARIOCARPUS.
  Upper surface of the tubercles with a longitudinal wool-bearing groove along the median line.
    Upper surface of tubercles strongly and irregularly fissured, 11–13 mm. long by 1.5–2.5 cm. broad. *A. fissuratus.*
    Upper surface of tubercles flat and finely papulose, about one cm. broad and half as long. *A. Kotschubeyanus.*
  Upper surface of tubercles not grooved.
    Tubercles reflexed and closely imbricated, giving a flat surface to the top of the plant. Upper surface slightly wavy to wrinkled, tinted with dull reddish-brown. *A. furfuraceus.*
    Tubercles more open, squarrosely spreading, more elongated, gray-green. *A. retusus.*

II. Tubercles scarcely evident; ribs quite prominent: plants decidedly succulent; epidermis flexible. LOPHOPHORA.
  Ribs commonly 8, quite regular. *L. Williamsii.*
  Ribs commonly 13, irregular to much broken. *L. Lewinii.*

Ariocarpus.*

Plants simple or very rarely cespitose, depressed top-shaped. Tubercles imbricated, radiating from the crown they form a rosette, made up of two parts comparable to the blade and claw as exemplified in some flowers. The lower portion or claw is flattened and more or less appressed along the body of the plant, the upper part or blade is reflexed, consisting of a more or less pyramidal body whose upper surface is triangular in outline. The entire surface of the blade is covered with a tough cartilaginous coat. This covering, and the absence of spines, separate these plants from Mamillaria, to which they are commonly referred and to which they are more closely related than to any other genus.

Ariocarpus fissuratus (Engelm.) K. Sch. in Engler-Prantl's Natür. Pflanzenfamilien 3^{6a}: 195. 1894.

Mamillaria fissurata, Engelm. Syn. Cact. 270. 1856.— Watson, Cactus Culture 160. *fig. 61*. 1894.

Anhalonium fissuratum, Engelm. Bot. Mex. Bound. 75. *pl. 16*. 1859.— L'Illustr. Hortic. **16**: 79. *1 fig.* 1869. Förster's Handb. Cact. 234. *fig. 20*. 1886 [ed. Rümpler].— Blanc, Catal. and Hints on Cacti 13. *no. 2*. 1888 [2nd ed.]. — Baltimore Cactus Journ. **2**: 247. *1 fig.* Jan. 1896.

This species is perhaps the most common one in cultivation, appearing in nearly every cactus lover's collection. It is so characteristic and well defined in its structure that it is entirely unnecessary to dilate upon it, since what would be written could only be a repetition of the work of former authors. Our plate gives an accurate representation of its habit of growth as well as the characteristic detail structure of the tubercles. An excellent plate with detail drawings is given in Engelmann's Botany of the Mexican Boundary. The portion of this plate showing the habit has been reproduced in the other publication cited above,

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* Scheidw. Bull. Acad. Royal Scien. Bruxel. **5**: 491. 1838. *Anhalonium*, Lem. Cact. 1. 1839.

and is also extensively used to illustrate dealers' catalogues both in America and Europe.— Plate 32.

ARIOCARPUS KOTSCHUBEYANUS (Lem.) K. Sch. in Engler, Bot. Jahrb. **24**: 544. *1 pl.* 1898.

Anhalonium Kotschubeyanum, Lem. in Cels Catal., in Bull. Cercle Confer. Hort. Dep. Seine. 1842 (vide K. Schumann, l. c.).

Anhalonium sulcatum, Salm-Dyck, Cact. Hort. Dyck. 5, 78. 1850 [2nd ed.].

Anhalonium Kotschubeyi, Lem. ex Salm-Dyck, Cact. Hort. Dyck. 5. 1850 [2nd ed.].

Anhalonium fissipedum, Monv. Cat. ex Förster's Handb. Cact. 232. 1886 [ed. Rümpler].

Anhalonium Kotschoubeyanum, Chr. Lem. l. c.

Stromatocactus Kotschoubey, Karw. l. c.

Ariocarpus sulcatus (Salm-Dyck) K. Sch. in Engler-Prantl's Nat. Pflanzenfamilien 3^{6a}: 195. 1894. — K. Sch. Monats. für Kakteenk. **7**: 9. *1 fig.* 20 Jan. 1897.

This interesting species was first introduced into European gardens in 1845 by Karwinski but soon disappeared, so that in later years when Dr. Engelmann was studying the family he was unable to find either living or herbarium material of it.* For nearly half a century it remained in obscurity, known only by its early record, until only a few years ago it was again discovered in its home in Mexico. Since that time it has found a place in many collections throughout the United States. The Missouri Botanical Garden received its first specimen only recently, through the purchase of the cactus collection of Mr. J. A. Becker of Baltimore, Md. Our plate is from a photograph of this plant. Like *A. fissuratus* it is characteristic in its habit and details and not to be confused with any other species. These features the plate gives so well as to insure the ready determination of a plant compared with it. At present I am able to refer to but one other figure, that above cited, which is a very good illustration of the plant. The same figure is used in both the places cited. — Plate 33.

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* Engelmann, Dr. George. Botany of the Mexican Boundary 75. 1859.

ARIOCARPUS FURFURACEUS (Watson).

Mamillaria furfuracea, Watson, Proc. Amer. Acad. **25**: 150. 1890.
Anhalonium furfuraceum, (Watson) Coulter, Contr. U. S. Nat. Herb. **3**: 130. 10 June, 1894.

This species seems to have never before been figured. Our plate is from a photograph of a plant received in the collection of Mr. J. A. Becker, before mentioned, under the name *Anhalonium prismaticum*, but a comparison with Dr. Watson's description as well as with his type material (Pringle no. 2580, 1889) leaves no question of doubt but that it is the Watson species. The characteristic flatness of the head is clearly shown as well as the slight wrinkling of the triangular upper surface of the tubercles. Another feature which is prominent in both the type specimen and our own plant is the peculiar bronze appearance of the surface of the tubercles. In comparison with *A. retusus* this species has a comparatively shorter tubercle, the upper surface of which is more nearly equilateral triangular.— Plate 34.

ARIOCARPUS RETUSUS, Scheidw. Bull. Acad. Royal des Sciences de Bruxelles **5**: 492. *1 pl.* 1838.

Mamillaria prismatica, Lem. Hort. Univ. **1**: 231. 1839.
Anhalonium prismaticum, Lem. Cact. 1. 1839.— Blanc, Catal. and Hints on Cacti 12, *no. 1*. 1888 [2nd ed.].— Bot. Mag. iii. **49**. *pl. 7279*. 1893.— Baltimore Cactus Journ. **2**: 266. *1 fig.* Feb. 1896.
Anhalonium retusum, Salm-Dyck, Cact. Hort. Dyck. 15. 1845.
Cactus prismaticus, Kuntze, Rev. Gen. Plant. 261. 1891.

This species is the oldest and, next to *A. fissuratus*, perhaps the most common in cultivation. A quite full description with a good plate showing the plant in natural size were first published by Scheidweiler and this publication forms the basis for the type of both the genus and this species. It seems, however, from the different publications, that the species is very variable in form, and this variation is well marked in those illustrations which have been published. Considering Scheidweiler's figure as the type, — and, in my judgment, it is a good medium of the forms, — we may with advantage compare the others

with it. The plant illustrated in the Botanical Magazine may be considered to represent the extreme variation in one direction, in which the tubercles are much shorter and more plump, and the wool-bearing apical areola quite prominent. In so far as I am able to gather any information concerning *A. pulvilligerus*, Lem.,* this seems to be the extreme variation in the contrary direction, in which the tubercles are distinctly prismatic and very much elongated. This also is described as bearing a prominent wool-bearing terminal areola. However, the presence of this areola appears to be inconstant both from the descriptions by different authors as well as from the plates, — the plate of Scheidweiler showing none. The figure in Blanc's catalogue, taken from a photograph, shows an intermediate stage between the Botanical Magazine plate and the type, in its form of tubercles as well as the small areola. This figure is quite extensively copied in the various dealers' catalogues both in America and Europe. Our own illustration shows a variation from the type toward *A. pulvilligerus*, having the same shaped tubercles, not prominently widening at the base, though considerably diminished in size. It is destitute of the terminal areola and in that respect and the smaller sized tubercles it approaches more nearly the type. This plant was growing in the Garden at the time of Coulter's study of the order, so it must have passed under his observation and been considered to be of this species. In suggesting the probable identity of *A. pulvilligerus* with *A. retusus* I might add that in all the descriptions that I have seen of the species, where the color is mentioned it is given as of some shade of gray. Whether the color is a constant feature I am unable to state, though it appears to be so. If it be true, the gray color of the tubercle would add a point in favor of the union of the two species and at the same time distinctly separate them from *A. furfuraceus*. — Plate 35.

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* *Anhalonium pulvilligerus*, Lem. Hort. Univers. **1**: 275. 1839.—*Anhalonium elongatum*, Salm-Dyck, Cact. Hort. Dyck. 77. 1850 [2nd ed.].

Lophophora.*

Plants simple or cespitose, depressed-globose to top-shaped or even short clavate, ribbed. Ribs bearing inconspicuous low tubercles on the summits of which appear the flower-bearing areolae. Areola round, spineless and bearing a tuft of straight, moderately long, silky hairs. In the presence of the ribs with the areolae distributed upon them in regular order, this genus approaches more nearly to Cereus or Echinocactus, and to the latter it has been referred by some authors. From a study of the vegetative character my conviction is that it constitutes a well defined genus. It differs from Echinocactus in having but the one kind of areola, and this always circular in outline, and in the total absence of spines. Furthermore the plant is more succulent in growth than in that genus. In these characters it is even further removed from Mamillaria and Ariocarpus. Its nearest relationship seems to be to the mamillate forms of Echinocactus.

Lophophora Williamsii (Lem.) Coulter, Contr. U. S. Nat. Herb. **3**: 131. 10 June, 1894.

Echinocactus Williamsii, Lem. in Allg. Gart. Zeit. **13**: 385. 1845. — Bot. Mag. iii, **3**. *pl. 4296.* 1847. — Monats. für Kakteenk. **4**: 37. *1 fig.* 20 March, 1894.

Anhalonium Williamsii, Lem. in Förster's Handb. Cact. 233. 1886. [ed. Rümpler].— Blanc, Catal. and Hints on Cacti 13, *no. 3.* Jan. 1888 [2nd ed.]. — Gartenflora **37**: 411. *fig. 5.* 1 Aug. 1888. — Baltimore Cactus Journ. **2**: 247. *1 fig.* Jan. 1896.

The characteristic form and habit of growth in this species are well portrayed in the accompanying plate. The illustration is from one of the largest plants and shows the characteristic convex, almost unbroken ribs. The division of these ribs into rows of tubercles is indicated only by a faint, short, horizontal line just below each areola and in some instances by the slightly sinuous direction taken by the groove between the ribs, though commonly this is,

* Coulter, Contr. U. S. Nat. Herb. **3**: 131. 10 June, 1894.

relatively, a straight line. Our figure represents a plant with ten of these ribs, the greatest number I have yet found for the species. Though this number is not especially rare, yet by far the most common number is eight, and rarely seven. The figure in the Botanical Magazine is a very excellent one in every respect. That in Blanc's catalogue is also good and is the one commonly seen in dealers' catalogues. The only one of the above cited figures that is at all questionable is Hennings' illustration in Gartenflora. If it truly is this species it must certainly have been taken from a very much depauperated plant. Certain it does not represent the typical species of the description nor does it in any way compare favorably with the two previously published figures. From the prominence of the tubercles it might readily be taken for a withered specimen of the following species. Our plate represents the true species as received from a number of different collectors and dealers.— Plate 36.

LOPHOPHORA LEWINII (Hennings).

Anhalonium Lewinii, Hennings, Gartenflora **37**: 410, *figs. 1–4*. 1 Aug. 1888.— Monats. für Kakteenk. **1**: 90. *1 pl.* Oct. 1891.

Lophophora Williamsii Lewinii, Coulter, Contr. U. S. Nat. Herb. **3**: 131. 10 June, 1894.

Echinocactus Lewinii, Hennings, Monats. für Kakteenk. **5**: 94. June, 1895.

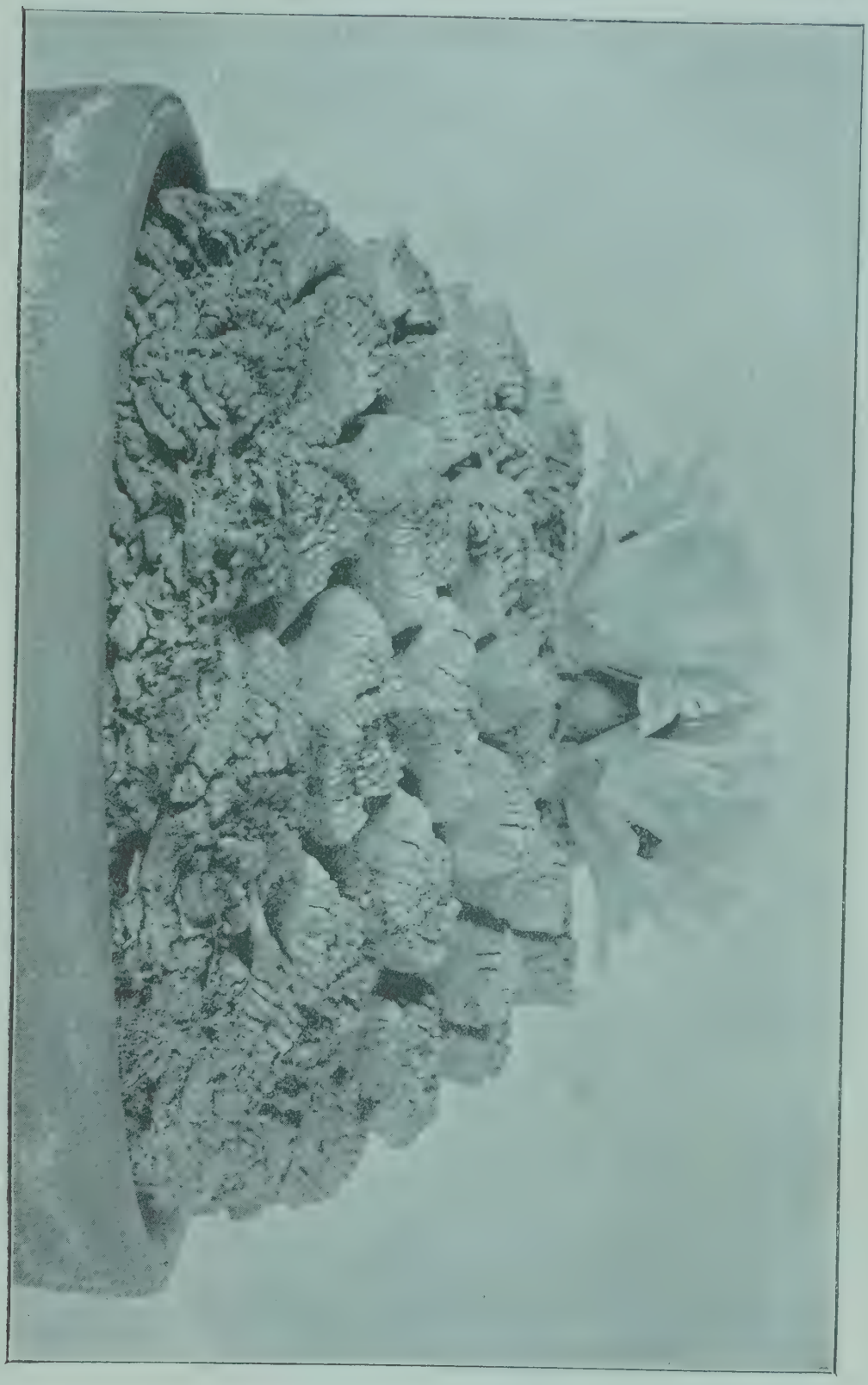
Though this species is somewhat more variable in the arrangement of its tubercles than the last, yet it seems to me in every instance to be readily distinguished and separable. The ribs, when distinct, are usually thirteen in number, though not uncommonly as few as nine. In these more regularly formed plants the groove between the ribs is very strongly sinuous. By far the most common form, and that shown in our illustration, is the one in which these ribs are divided into irregularly outlined tubercles by secondary grooves obliquely intersecting two primary grooves at the point of constriction in the rib between two superposed areolae. While these limiting grooves give a con-

spicuous tuberculate appearance to the surface of the plant, at the same time the tubercles themselves do not prominently rise above the general surface. The plants at the Garden have been received from various sources and the one which furnishes us our illustration seems to be typical of the species as handled by dealers. Hennings, in his original description in Gartenflora, used a boiled-up dried specimen as the subject of his illustration. This is always unsatisfactory, and in this instance it seems that some discrepancies have crept in. A comparison of the illustration with our own will show scarcely any resemblance, though it is possible to see how a plant such as our own might, in drying, take on the prominent tubercular form he figures. But I am unable to account for the large cushion of silky hairs which covers the entire crown of the plant in his illustration. Such an instance has never as yet come under my own observations, neither have I heard of anyone else seeing anything like it in this group of cacti. Hennings received his type material from Parke, Davis and Co., of Detroit, Mich., and to dispel any doubt that our plant is *L. Lewinii* I secured a living specimen of the plant from this firm, one they consider typical of the species. This plant is exactly the same in characters as the one we here reproduce in our illustration. The illustration given in Monatsschrift für Kakteenkunde is almost equally unsatisfactory in presenting the prominent features of this species. To me it appears to be no more than an unusual form of *L. Williamsii* in which the characteristic number (eight) of ribs is shown, though they are perhaps a little more inclined to be tuberculate. The grooves are deeper and the plant body more elongated than in any specimens I have yet seen in either species. — Plate 37.

EXPLANATION OF PLATES ILLUSTRATING ARIOCARPUS AND LOPHOPHORA.

The plates are all reproductions of photographs taken of plants now growing in the Missouri Botanical Garden. The figures are presented in natural size.

Plate 32. *Ariocarpus fissuratus.*
Plate 33. *Ariocarpus Kotschubeyanus.*
Plate 34. *Ariocarpus furfuraceus.*
Plate 35. *Ariocarpus retusus.*
Plate 36. *Lophophora Williamsii.*
Plate 37. *Lophophora Lewinii.*

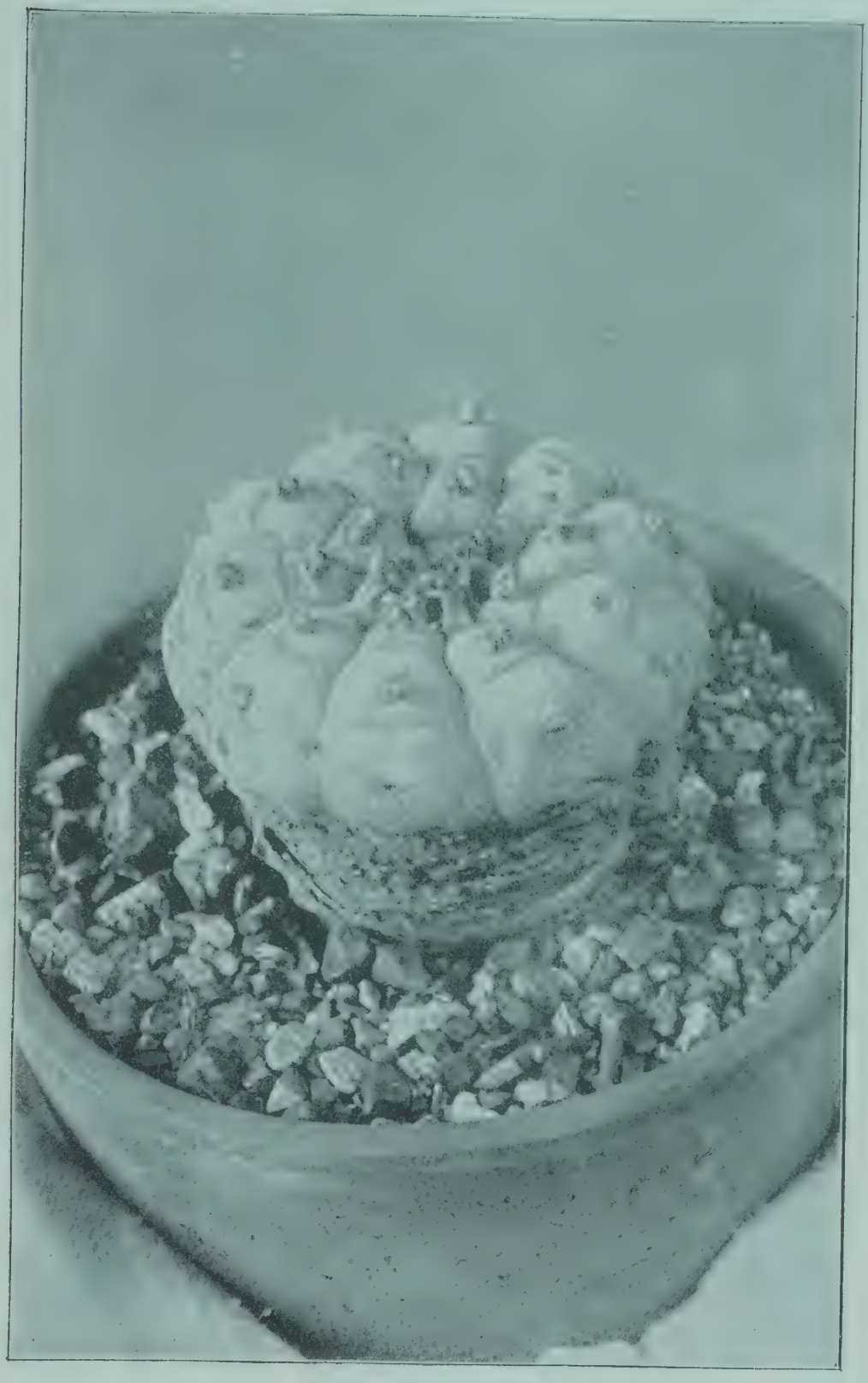


ARIOCARPUS FISSURATUS.

ARIOCARPUS KOTSCHUBEYANUS.

ARIOCARPUS FURFURACEUS.

ARIOCARPUS RETUSUS.



LOPHOPHORA WILLIAMSII.

LOPHOPHORA LEWINII.

NOTES AND OBSERVATIONS.

1. THE EPIDENDRUM VENOSUM OF FLORIDA.

BY WILLIAM TRELEASE.

Occasional reference has been made to the occurrence of *Epidendrum venosum*, Lindley, in southern Florida,* the only other species of the genus commonly recognized as pertaining to that flora having been *E. conopseum*, Brown, until the recent appearance of the third edition of Dr. Chapman's Flora, which adds *E. Tampense*, Lindl., *E. cochleatum*, L., *E. umbellatum*, Sw., and *E. nocturnum*, L., while *E. venosum* has been dropped from the southern flora.

In February 1893, while collecting along the St. John's river, Mess. W. T. Swingle and Theo. Holm found some fine specimens of what has passed for *E. venosum*, which they sent to the Garden, where, subsequently, a number of other collections of the same species have been received and kept under observation for several years. All of these pertain to *E. Tampense*, Lindl.†

Epidendrum Tampense was first collected on Tampa Bay, Florida, by Dr. Torrey, many years ago, and was found in Miami by Garber in 1877, and on the Hillsboro river by Curtiss (no. 2805). Within the last few years it has been collected at various points in the southern part of the State, and Mr. T. L. Mead informs me that at Oviedo (as is doubtless true at many other places), it is abundant. It belongs to Lindley's subgenus *Encyclium*, which has the stem enlarged into a pseudobulb, flowers not

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* *e. g.* Chapman, Flo. So. U. S. 1 ed. 455. American Agriculturist. **33**: 344. 1874.

† Lindley, Bot. Register, n. s. **10**, under pl. 35. 1847; Folia Orchidacea, Epidendrum, no. 34, p. 12. 1853. Britton, Trans. N. Y. Acad. 1889, p. 12. Chapman, Flo. So. U. S. 3 ed. p. 480. 1897.

subtended by a spathe, and the labellum only slightly adnate to the column — whereas in the greater part of the genus it is attached much further up this member. The trilobed labellum, with the lateral lobes longer than broad and the median lobe broadened, marks it as belonging to the group *Hymenochila* of Lindley.

Though one of the plainer species, it is worthy of cultivation, and succeeds well with ordinary treatment. The appearance of its flowers is well shown in the appended colored plate, which is reproduced from a water color sketch by Miss Grace E. Johnson.

In February, 1896, the Garden received from the Mexican Plant Company, of Maravatio, an orchid which bloomed in April of the same year and then proved to be the true *Epidendrum venosum* of Lindley.* In this species the claw of the 3-parted labellum is adnate to the basal half of the column, and the raceme of flowers is terminal on the pseudobulb stems,— characters which place it in Lindley's section *Aulizeum*. The following description, drawn from the living specimen by Mr. C. H. Thompson, and the accompanying halftone from a photograph, show how different this Mexican species is from that which has passed for it in Florida:—

The stem proper is cylindrical, 4–6 mm. in diameter and almost entirely enclosed by the close-fitting thin papery leaf scales. The pseudobulbs are about 3.5–4 cm. long, slightly compressed ovoid in the flowering ones to slightly compressed fusiform in some of the older and sterile ones — the two diameters ranging between 9 × 12 mm. in the latter and 18 × 28 mm. in the former, measured at their broadest points.

The fertile pseudo-bulb is crowned by three linear-lanceolate leaves about 13 cm. long by 15-18 mm. broad in the middle. From a straw-colored membranaceous sheath in the axil of the uppermost leaf rises the five-flowered raceme. The sheath is about 2 cm. long. Each flower is subtended by a minute clasping acute pointed triangular paleaceous bract about 3 mm. long. The two-ranked one-sided raceme is 11 cm. long. Peduncles about 12 mm. long and equaling the

* Lindley, Genera and species of Ochidaceous Plants, p. 99. 1830–40; Folia Orchidacea, 1, Epidendrum, p. 34. Jan. 1853. Bentham, Plantae Hartwegianae, p. 52. 1839.

ovary. Sepals petal-like, spreading, linear-lanceolate, 13 mm. long, 3 mm. broad, acute, revolute, whitish-green on the back, ground color of the inner surface greenish-yellow, changing in age to orange-yellow, almost covered by five broad parallel brownish-purple lines extending from the base to very near the apex with similar transverse lines connecting them at regular intervals. The upper petals spreading, linear-lanceolate, 11 mm. long, scarcely over 2 mm. broad, gradually narrowing in the lower two-thirds to the base where they are only about half as broad as the sepals, giving them an almost linear-spatulate form, acute, slightly revolute. The coloring is exactly as in the sepals, with three distinct bands of purple and two outer narrower obscure ones. The lower petal, forming the lip, is of the same length, broader at the base (about 2 mm.) continuing the direction of the ovary. The basal portion, attached to the column, is about 3 mm. long and has the margins parallel. Beyond this the petal forms the obovate three-parted blade of the lip. Each lateral division is falcately elongated triangular, curving upward and inward, acute, body color white, with two prominent parallel purple lines extending about two-thirds its length, with two other obscure ones near the base, all confluent below, forming a broad line parallel with the column. The middle division is round ovate with a deflexed keel-like apex and crisp margin. The inner surface is marked with five much wrinkled almost parallel ridges, the middle one extending from the throat almost to the apex, the next pair slightly shorter, the outer pair about half as long. Near the end of this outer pair the margin has a more or less prominent fold. The ridges are finely wrinkled transversely. The throat is villous pubescent. Coloring is white throughout the upper surface when first opening, but with age gradually changing to ochre yellow, as does also the ground color of the lateral divisions. The under surface is green from base to apex with the margins of the middle lobe white as above. The column is triangular prismatic, about 6 mm. long by nearly 2 mm. broad, very slightly larger at the upper end. The body color is green. Two narrow purple lines extend along the margins from the base almost to the top, and one more or less broken one along the central ridge, becoming a mottled splotch toward the top. The column ends in three callous horns, one at each angle, the upper or central one slightly larger and truncate, the lateral ones rounded. These are white, changing to ochre yellow in age. In the fork of the three horns are situated the pollen masses with their cover. Seen from above, this cover is broadly oval, slightly constricted in the middle, yellow, changing to orange in age, with a row of purple dots along the lateral margins. The cap is supported behind by a minute spur, and below by the projecting upper part of the stigma. The four pollen masses are arranged in pairs by the recurved adherent caulicles of each end pair being united by their margins at a point near the base. The stigmatic surface is a deep glossy green-colored pit about 1 mm. in diameter.

EPIDENDRUM TAMPENSE.

EPIDENDRUM VENOSUM.

2. MISCELLANEOUS OBSERVATIONS ON YUCCA.

BY WILLIAM TRELEASE.

YUCCA GIGANTEA.

In the course of a walk through the celebrated gardens of José do Canto in Ponta Delegada, St. Michaels, in August, 1894, in company with their owner, my attention was attracted by a magnificent Yucca, some thirty feet high, and with a trunk not far from three feet in diameter, which at that time was covered with immense erect panicles of white flowers. Some few of the flowers which had fallen to the ground, showed the structure characteristic of *Y. gloriosa*,* and the leaves, which were all at a considerable height, though somewhat large and relatively broader than is usual in that species, appeared to have the usual longitudinal plication of *Y. gloriosa*, to which species I then supposed that the plant belonged.

Unfortunately the tree was seen just on the eve of my departure from the Azores, so that I was unable to make a study of it on the spot; but my friend Captain F. A. Chaves was obliging enough the next summer to make for me the photographs which are here reproduced. Though in 1895 only two panicles of flowers were produced, in place of the many observed the preceding summer, one of these was cut and separately photographed, so that its character as well as that of the leaves, specimens of which (over $2\frac{1}{4}$ in. wide and nearly a yard long) were sent to me, is sufficiently illustrated.

In the course of my conversation with Sr. do Canto, I asked if this tree had ever been known to fruit, knowing that *Yucca aloifolia* commonly sets fruit under cultivation,† and that *Y. gloriosa* (but apparently usually by

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* Rept. Mo. Bot. Gard. 3. *pl. 50.*

† Rept. Mo. Bot. Gard. 4: 182.

error) occasionally has been said to do so, when the Yucca Moth is not present to effect pollination;* and I was informed that this particular tree has several times ripened a number of fruits, from which seedlings have been raised. Seeing my interest in the matter, Sr. do Canto was kind enough to instruct his gardener that if any fruits ripened that year they were to be saved for me, and toward the end of the following winter I received two, which are closely comparable with those of *Y. gloriosa*, possessing the firm core and tardily drying indehiscent pulp of that species;† though the somewhat greater thickness of this pulp goes to show the relationship of the Clistoyuccas, as represented of *Y. gloriosa*, *Y. gigantea* and *Y. brevifolia*, with the Sarcoyuccas, of the *aloifolia* and *Guatemalensis* type.‡ Several seedlings, from an earlier fruiting of the tree, were also sent to the Garden, where, with a few raised from the relatively few good seeds of these fruits, they are in cultivation.

Though in flower, fruit and seed characters, this tree might well pass for *Y. gloriosa*, it is much larger than any specimen of that species to which I have found reference,—a fact perhaps in part due to the very favorable climate of the Azores. But on closer examination its leaves prove also quite different from those of *Y. gloriosa*, in that they are large and broad, as in *Y. Guatemalensis*, to which, indeed, barring the absence of a slight roughness on the principal plications, they bear close resemblance, while they are slightly roughened on the margin and much more plicate longitudinally than in any form of *Y. gloriosa* that I have examined. Although the trunk does not appear to be dilated below as is that of *Y. Guatemalensis*,§ — at least in specimens of the size cultivated in plant houses, — the seedlings are strongly bulbously dilated at the base of the

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* Rept. Mo. Bot. Gard. **4**: 199.—Sargent, Silva **10**: 24.

† Rept. Mo. Bot. Gard. **3**: 165. *pl. 50*. 1892.

‡ Rept. Mo. Bot. Gard. **4**: 224.

§ Rept. Mo. Bot. Gard. **4**: *pl. 1*.

first phytomer, even after they have reached a considerable size.

On the whole, therefore, it seems necessary to recognize *Y. gigantea* as distinct from *Y. gloriosa* and *Y. Guatemalensis*,— its nearest allies, and the Azorean specimen here figured may be taken as an excellent example of this species. Concerning it, Sr. do Canto informs me that it was purchased as a 2- or 3-year old seedling, in March, 1854, from Makoy, of Liége, under the name of *Dracaena*, sp.

Yucca gigantea * was first described and named by Lemaire, who found it in flower in October, 1859, in the houses of M. Verschaffelt, of Gand, who had obtained it from an amateur near Antwerp, who knew nothing of its origin and had seen only two or three specimens. M. Lemaire states that until it bloomed he had regarded it as an unpublished species of *Dracaena* (under which name, as above stated, it appears that Sr. do Canto had purchased it some five years earlier) or perhaps of *Fourcroya;* and he assumes its native home to be probably Mexico.

Some three years ago, the Garden received from Dr. F. Franceschi, of Santa Barbara, Cal., a small plant of the same species, which, with three others, he had obtained from a European correspondent, all of them being rooted cuttings of the stem of an older plant which he thinks came from Belgium, probably from the original collection on which the specific description was based. Dr. Franceschi adds that he does not know that seeds of it have ever been handled by the trade; and that on a young specimen planted out in his grounds the leaves have reached a length of four feet, and a breadth of four inches.

While the relatively large size of all of its parts, as shown in house-grown specimens, seemed so striking to the author of the species as to lead him to call it "the king," "the

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* Lemaire, Illustr. Horticole 6. Miscellanées 91. Nov. 1859; Revue Horticole 9: 222. 1860.— Baker, Journ. Linn. Soc., Bot. 18: 224. 1880.

giant" of its genus, the development which it may assume when grown in the open air in a favorable climate still more justifies the intensive specific name given to it.

Memoranda on the Pollination of Yuccas.

In the Fourth Report of the Garden a résumé of what was then known of the pollination of Yuccas was given, and the results of a somewhat extensive field study of several species were published.* Since the publication of that paper, so far as I know, no considerable addition has been made to our knowledge of the subject, except that in the following year Professor Whitten filled a gap in the observations on *Y. filamentosa* by observing and describing the circumstances attending the emergence of the *Pronuba* larvae from the capsules of that species.†

In the meantime the arborescent species have been subjected to a critical systematic study by Professor Sargent, who has found it necessary to adopt names for some of the species which differ from those employed in my ecological paper, so that, as a means of avoiding confusion it is to be noted that the following changes in nomenclature should be made in my paper, to conform it to Professor Sargent's revision.‡

Y. baccata, Trelease, Rept. **3**. *pl. 2*.— **4**: 185–190. *pl. 20*, which is the arborescent form, becomes *Y. Mohavensis*, Sargent, Silva **10**: 15–16. *pl. 500*. No observations on the pollination of the true dwarf *Y. baccata*, therefore, appear to have been published.

Y. australis, Trelease, Rept. **4**: 190–192. *pl. 4–5*, by priority becomes *Y. macrocarpa*, Coville,— Sargent, Silva **10**: 13–14. *pl. 499*. In the early part of 1897, while attempting to study the pollination of *Y. Treculeana*, in

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* Trelease, Further studies of Yuccas and their pollination. Rept. Mo. Bot. Gard. **4**: 181–226. *pl. 1–10, 15–23*. 1893.

† Whitten, The emergence of Pronuba from the Yucca capsules. Rept. Mo. Bot. Gard. **5**: 137–8. 1894.

‡ Sargent, The Silva of North America **10**. 1896.

southeastern Texas, I met Mr. Samuel T. Tyson, a mining engineer, of Mapimi, Mexico, who became sufficiently interested in the subject to promise to observe what he could on the arborescent Yuccas of the mountains of Durango, and about the middle of April I had the satisfaction of receiving from him several specimens of *Pronuba* obtained from the flowers of the common "Palma" of that region, which is described as having an upright panicle, and is evidently the same as the Carneros Pass specimens of Mr. Pringle, which have generally been referred to the present species.* The moths, the females of which were abundantly laden with pollen balls, and concerning the activity of which in the pollination of this species there can be no doubt, though they were not actually observed at work, prove to be *Pronuba yuccasella*. This moth, therefore, is shown to be the active agent in the pollination of Yuccas from Florida northward as far as fruit is set as a result of *Pronuba* activity, westward as far as southern California,† and into the mountains of northern Mexico, to the south.‡ Whether, as Professor Riley surmised,§ *Y. Treculeana*, lying in the region between Southwestern and Mexican species not known to be pollinated by *P. yuccasella*, and *Y. filifera*, the "Palma de San Pedro," occurring in northern Mexico with *Y. macrocarpa*, but, as Mr. Tyson writes, blooming later than the latter, more dependent upon the rains, and consequently more variable in its time of flowering, are pollinated by distinct species of moths, remains to be shown by direct observation, but so far as the former is concerned, this is doubtful.

Y. brevifolia, Trelease, Rept. **4**: 193–9. *pl. 6–9, 21*, becomes, for reasons of priority, *Y. arborescens*, Trelease,— Sargent, *l. c.* **10**: 19–21. *pl. 502*.

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* Trelease, l. c. **4**: 191.— Sargent, l. c. **10**: 14.

† Trelease, Rept. **4**: 222.

‡ The Mexican specimens here referred to have been deposited in the National Museum.

§ Rept. Mo. Bot. Gard. **3**: 121, 122.

In another part of the present volume I have shown that *Y. gigantea*, which has usually been confounded with *Y. gloriosa*, like *Y. aloifolia* sometimes sets fruit without the intervention of *Pronuba*.*

Y. elata, Trelease, Rept. **4**: 193–9. *pl. 10, 15, 22*, for like reason of priority becomes *Y. constricta*, Buckley,— Sargent, *l. c.* **10**: 27–8. *pl. 504.*

A Proliferous Yucca.

Some years since, while collecting in the Southwest, Miss A. I. Mulford secured an inflorescence of *Yucca constricta* (*Y. elata*) which is figured on the accompanying plate, in which the upper bracts subtend rather dense clusters of short ultimately slightly filiferous leaves, above some of which flowers stood, so that the fascicles evidently represent the upper branches of a normal panicle. But the most interesting feature of the specimen is an apical tuft of more filiferous leaves about five inches long, which, though somewhat intermediate in character between bracts and foliage leaves, clearly act as the latter.

A number of species of *Agave*, of the Euagave section, are known to be normally viviparous, producing bulblets in place of many of the flowers in their panicles, and occasionally the production of bulblets in the inflorescence of an *Agave* of the section Littaea has been observed,† but I am not aware that anything of the kind, or anything approaching the present case, has yet been recorded for *Yucca*.

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* Supra, pp. 141–2.

† Miss Mulford, Rept. Mo. Bot. Gard. **7**: 56. *pl. 62*.— Rose, Rept. Mo. Bot. Gard. **9**: 122.

YUCCA GIGANTEA.

YUCCA GIGANTEA.

YUCCA GIGANTEA.

TERATOLOGICAL YUCCA CONSTRICTA.

3. THE MISSOURI DOGBANES.

BY WILLIAM TRELEASE.

The discovery of *Apocynum androsaemifolium* by Mr. Geo. W. Letterman, in one locality at Allenton, Mo., where *A. cannabinum* is abundant, gave the opportunity in May, 1895, to make photographs from which the accompanying plates have been made, and to confirm Mr. Letterman's observations on their different manner of growth. At Allenton, both species grow on the rocky hills, in or about thickets of various shrubs and small trees. In *A. cannabinum* the main stem is percurrent, and the branches relatively short from the axils of large leaves, which, on both stem and branches, are ascending, and the greenish-white flowers with short suberect corolla lobes are densely clustered in the upper axils. In *A. androsaemifolium* the stem is more or less spirally dichotomous above, and even the lower branches are elongated and divergently ascending, the leaves of the main stem are relatively short, and, like the larger ones of the branches, drooping or quite pendent, while the larger bell-shaped white or pinkish flowers with recurved segments are much more loosely clustered, forming more showy terminal cymes.

Since the preparation of the foregoing note and the accompanying illustrations, Professor Greene * has well indicated the differences between *A. androsaemifolium* and *A. cannabinum*, in his diagnosis of *A. medium* and *A. album*, two species of the habit of the latter but differing in details,— neither of which has yet been recognized in Missouri material.

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* Pittonia 3: 229. 1897.

APOCYNUM CANNABINUM.

APOCYNUM ANDROSAEMIFOLIUM.

4. A COLORING MATTER FOUND IN SOME BORRAGINACEAE.

BY J. B. S. NORTON.

Some time last summer Mr. J. G. Smith, of the Division of Agrostology, sent a small specimen from Grant Co., New Mexico, to the Missouri Botanical Garden for identification, which I decided to be *Plagiobothrys Arizonicus* Greene. Mr. Metcalfe, who collected the plant, says that "when the sheep find a patch of it, it colors their heads red clear to their ears." The herbage of the dried plant had stained the letter which unclosed it a violet purple, something like wine stains. Mr. A. M. Ferguson tells me that a plant of western Texas, doubtless also some species of *Borraginaceae*, is known to affect sheep in a similar manner. The New Mexican plant is known there as blood purslane, says Mr. Smith in a recent letter, and is fine for sheep pasture in the spring.

These facts prompted me to further investigate the matter. I examined the other specimens of the same species and others of that genus and related genera in the Garden herbarium and found that a number of specimens had stained the paper in the same way, some through as many as five herbarium sheets. The color spreads through the paper from the mounted plant, though in what manner I have not been able to ascertain.

It is well known that a coloring matter is common in the roots of several species of *Borraginaceae* and the substance is probably the same in all. It is known as alkannin, and is a non-nitrogenous, resinous, purple coloring matter, soluble in oils, alcohol and ether but not soluble in water.* alkannin or alkanet (or alcanet), as the dye is called, is

* The information regarding the properties and uses of alkannin is taken from Tschirch, Angewandte Pflanzenanatomie, The United States Dispensatory, and The Century Dictionary.

obtained from the root bark of *Alkanna tinctoria* which is cultivated in South and Central Europe for the dye which is used in pharmacy for coloring salves, and for coloring wine and other liquids sold as wine. Alkanet is also an excellent test for resins and oils, to which it gives a red color, and is used in microchemistry as a reagent for these substances. The dye is said to give a brilliant violet color with iron and alum mordants to linen, cotton and silk, but not to wool. The fact that the wool on sheep grazing among growing plants is colored is probably due to the alkannin being dissolved in the oil of the wool. In the old world alkannin occurs also in quantity of commercial value in *Arnebia*, *Echium*, *Symphytum*, *Onosma* and *Lithospermum*.*

In a brief examination I have found but a few references to this color in American *Borraginaceae*. The color in the roots of species of *Lithospermum* (the puccoon of the Indians) is well known; and Dr. Gray in the Synoptical Flora, mentioned one species of *Plagiobothrys* (*P. Torreyi*), the herbage of which "gives an abundant violet stain to paper." It is opposed in this character to *P. ursinus* of similar habit, but "imparting no violet stain to paper." *P. tinctorius* (Ruiz & Pavon) Gray, Proc. Am. Acad. **20**: 283, of South America, is also described as "papyros violaceo colore tingens."

An examination of the herbarium material of the Garden shows that the coloring matter is abundant enough to stain the herbarium paper in the following species, chiefly in the roots: *Echium vulgare*, *Eritrichium glomeratum*, *Krynitzkia barbigera* (abundant in leaves), *K. Californica* (slight), *K. maritima*, *K. micrantha*, *K. pterocarya*, *Lithospermum multiflorum*, *L. strictum*, *L. spathulatum*, *L. hirtum*, *L. canescens*, *L. angustifolium* (not abundant), *Plagiobothrys canescens* (in leaves), *P. nothofulvus* (in leaves), *P. tenellus*, *P. Arizonicus* (abundant in stem and

* Engler & Prantl, Pflanzenfamilien 4^{3a}: 73, 113, 124, 127.

leaves as well as root), *P. Torreyi* (very abundant in some specimens, others with hardly a trace).

The coloring matter in the American plants seems to be the same as that derived from *Alkanna tinctoria*. Though I know of no analysis of any of the American *Borraginaceae*, Professor Pammel and myself have obtained the characteristic reactions from the leaves and roots of *Plagiobothrys* with resin and oils. The color is also very persistent on the hands after handling the plants. Perhaps some economical use may be made of our American plants.

5. NOTES ON SOME PLANTS, CHIEFLY FROM THE SOUTHERN UNITED STATES.

BY J. B. S. NORTON.

The following notes and descriptions are based principally upon an examination of several collections from the Southern States, which have been acquired by the Missouri Botanical Garden during the past year, with the addition of a few others from scattering collections which I deemed especially noteworthy. The larger collections are: (1) The herbarium of the late Dr. Joseph F. Joor, of New Orleans, La., containing a few thousand plants, mostly his own collections in southern Louisiana and Mississippi, and in eastern Texas, a region not well known botanically. The collection is especially rich in grasses and grass-like plants, none of which I have included here, these notes being mainly on such plants as seemed noteworthy in preparing the plants for the herbarium. A further examination of the collection will no doubt reveal many things of interest concerning the botany of the South. (2) The herbarium of Gustave Jermy, of San Antonio, Texas, which contains practically a complete representation of the flora of Gillespie Co., Tex. A large part of these have been noted in Coulter's Botany of Western

Texas as, "reported from Gillespie Co.," "Jermy," etc. I have made but little mention of these here as I believe that a further examination of this interesting collection may justify the publication of a complete list. (3) A collection of about 200 plants from San Antonio, Tex., which were recently sent to the Garden for identification by Mr. E. H. Wilkinson. (4) Collections made in various parts of southern Texas by Dr. Trelease during the spring and autumn of 1897.

CEBATHA CAROLINA (L.) Britton.

A desert form of this usually climbing species collected at San Antonio, Texas, by Wilkinson, has short ascending branches only 15–20 cm. high with leaves thicker than usual.

SARRACENIA FLAVA L.

Collected by Dr. Joor at Lakeland, in central Louisiana, which is probably the western limit of this species.

STIPULICIDA SETACEA Michx.

Collected on the Mississippi Gulf coast at Long Beach, by Dr. Joor. This has not to my knowledge been before reported west of Florida. The specimen is a poor one and may be Nash's *S. filiformis* if the two species are distinct.

HIBISCUS LASIOCARPOS Cav.?

Stem slightly pubescent; upper leaves ovate lanceolate, subcordate, acuminate, dentate-serrate, glabrous above; petioles adherent to the pedicels; bracts somewhat ciliate hairy; calyx lobes acuminate, prominently nerved; petals distinctly yellow in dried specimens; young capsules with a few short hairs.

The above description characterizes two plants collected by Dr. Joor in Louisiana, one on the lake shore at West End near New Orleans, 1890; the other on the Sabine river opposite Orange, Texas, in 1884. This may be *H. incanus* Wendl., which is listed from Louisiana, in Riddell's Catalogus Florae Ludovicianae, but in the Synoptical Flora is

given only west to Alabama; but seems to me nearer *H. lasiocarpos* of which other dried specimens show the yellow color ascribed to *H. incanus* though not so pronounced as in the Joor specimens. Nash's no. 673 from Florida in the Garden herbarium labeled *H. incanus* has very hirsute capsules and in that and other characters comes near to *H. lasiocarpos*, but the pubescence is more like that of *H. Moscheutos* and *incanus*. It seems evident that more study of this section of *Hibiscus* will be necessary to separate well the species composing it.

KALLSTROEMIA PARVIFLORA n. sp.

Primary branches a foot or two long, covered with long spreading hairs or glabrate below; leaves short petioled, with 3–4 pair of leaflets; leaflets 6–12 mm. long, oblong, usually acute, with appressed pubescence; pedicels 15–20 mm. long, longer than the leaves; sepals linear-lanceolate, persistent, in fruit longer than the carpels; petals light yellow, 6–8 mm. long; fruit minutely appressed pubescent, splitting into 8–10 nutlets, short tuberculate on the back; the persistent style 5–8 mm. long, longer than the carpels.— Collected at Agricultural College, Miss., by Pollard, Aug., 1896, no. 1295, and at San Antonio, Texas, by E. H. Wilkinson, 1897, no. 184.— Plate 46.

Nearest *K. grandiflora* of the Southwest United States, but differs from that species in the smaller leaves with fewer leaflets, and smaller flowers. Said by Mr. Wilkinson to be common at San Antonio.

JUSSIAEA OCTONERVIA Lam.

Among the Wilkinson plants from San Antonio, Tex.; also collected at New Braunfels by Lindheimer, but not given in Coulter's Botany of Western Texas.

MEGAPTERIUM OKLAHOMENSE n. sp.

Stems decumbent or ascending, branches $1\frac{1}{2}$–3 dm. long, whole plant glabrous even when young; leaves coriaceous, lanceolate, with remote teeth in the thickened margin, or

sometimes entire, 6–9 cm. long, attenuate to a long petiole; calyx tube 8–9 cm. long, the lobes purple spotted, tips free and slender; flowers 4–5 cm. in diameter; capsules oblong, about 3 cm. long, wings less than 1 cm. wide, short pedicelled; seeds crested but scarcely tuberculate. — Specimens examined: Waugh, Marena, Oklahoma, 1893, No. 183; Hitchcock, Barber Co., Kan., 1895, No. 165*a*.—Plate 47. f. 1–3.

Differs from *M. Missouriense* (Sims) Spach, in the absence of all pubescence, the smaller flowers and fruit, the latter oblong and more tapering at the apex, and the thick more dentate leaves with a thick marginal line.

MEGAPTERIUM FREMONTII (S. Wats.) Britton.

Watson describes the seed as "not crested nor tuberculate." In specimens from Kansas (Hitchcock, no. 165) the seeds are prominently crested and also somewhat tuberculate.—Plate 47. f. 4.

MEGAPTERIUM MISSOURIENSE (Sims) Spach.

There seems to be a marked difference in the seeds of different forms of this species, but I have not had opportunity to examine enough material to see whether the characters remain constant for the different forms or not. The seeds of the narrow-leafed Texan forms (var. A, Gray, Boston Jour. Nat. Hist. **6**: 188) are light colored and have a crest sometimes 2 mm. broad with dentate or entire margin and extending almost the entire length of the seed. The seeds of the form common further north are smaller, darker colored and have a laciniate or lobed crest extending about half the length of the seed.— Plate 47. f. 5–6.

LILAEOPSIS CAROLINENSE Coulter and Rose.

In the Joor herbarium is a specimen of this species recently described from plants collected on the Atlantic coast. The plant bears the following label in Dr. Joor's handwriting: "Crantzia, n. sp.? Peduncles less than $\frac{1}{4}$ length of lvs. Lvs. flat, with distinct lamina. Fls. pinkish.

Louisiana Av. Swamp May 8, 1889. Joor." About one-half the fruits examined have an additional oil tube and rudimentary rib on one side next the commissure. I have also referred to this species another plant collected in the same locality by A. B. Langlois, May, 1880. This plant is more slender and has much longer peduncles.— Plate 48.

LOBELIA CARDINALIS L.

In July, 1897, I noticed this species flowering in the bog in the Garden, and it seemed to me, much earlier than I had seen it in flower in Kansas the year before. An examination of the herbarium showed the following time of first flower, as nearly as could be ascertained from dried specimens and the dates of collection: Average of 7 plants east of the Mississippi river, Aug. 6; average of 5 Missouri plants, Aug. 24; average of 5 Kansas and Indian Territory plants, Sept. 5; average of 4 Texas plants, Sept. 12; one Mexican specimen of *L. splendens*, Oct. 15.

The western specimens form a transition from *L. cardinalis* of the East United States to *L. splendens* of the Southwest. The leaves are larger and narrower than the eastern form, more glabrous and less serrate, but I think it hardly deserves a varietal name.

EUPHORBIA COROLLATA JOORII n. var.

Plant 10–14 cm. high, branching from the base, glabrous or pubescent; leaves ovate; involucres long pedicelled (10–25 mm.), appendages of the glands unequal in size, one or two shorter than the rest, sometimes narrower than the gland.— Plate 49.

The collections of Dr. Joor in eastern Texas furnish this variety of this polymorphous species. The plants are from Milano, Texas. Most of them are glabrous or nearly so, but one, otherwise similar, is very pubescent with long hairs.

EUPHORBIA EXSTIPULATA Engelm.

This species, hitherto known only from Arizona, New Mexico, and western Texas, is represented in Wyoming by

Nelson's number 549, distributed as *E. dentata*. This species very much resembles small, narrow-leafed forms of *E. dentata*, in habit. Especially do those with wider ovate or oblanceolate leaves, of which the following are examples: Pringle, Arizona, 1884; Rusby, N. Mex., 1880, no. 379; Miss Mulford, New Mex., 1895. The figure in Boissier's Icones Euphorbiarum, probably from Wright's specimen, represents the narrow-leafed smoother form.

ACALYPHA LINDHEIMERI Muell.

The species has been described as having the leaves acute at the base. All the specimens I have seen from the United States have the base, except in the upper leaves, obtuse, and in many subcordate. Specimens collected by Wilkinson at San Antonio, Tex., lack the spreading pubescence on the stem.

SAGITTARIA ARIFOLIA AQUATILIS, J. G. Smith in herb.

Aquatic; leaves floating, petioles slender, 2–6 dm. long, leaf blade narrow, basal lobes usually curved inward; phyllodia long linear; fertile pedicels mostly 1 cm. long; stamens somewhat thickened at the base; mature achenes not seen.— Specimens examined from Lake Pend d' Oreille, Idaho, collected by Leiberg, 1891, no. 526, also by Henderson, same locality, 1897, no. 2977, "in water 6–12 inches deep." It may be that the specimen collected by Davis, Alma, Mich., 1890, with broad linear lanceolate phyllodia belongs here.— Plate 50.

Perhaps a distinct species but seems to be connected with typical *S. arifolia* by some of the Leiberg specimens of which there is a full series from water a few inches to several feet deep. The characters of the variety as given above slightly amplify the description of the species as published in Mr. Smith's monograph of the genus.

EXPLANATION OF PLATES.

The figures were drawn by Miss Grace E. Johnson from specimens in the herbarium of the Missouri Botanical Garden, or, in case of the details, from the author's sketches.

Plate 46. *Kallstroemia parviflora.*— Branch, one-half size; fruit, from above, × 2½; carpel and style, from side, × 5.

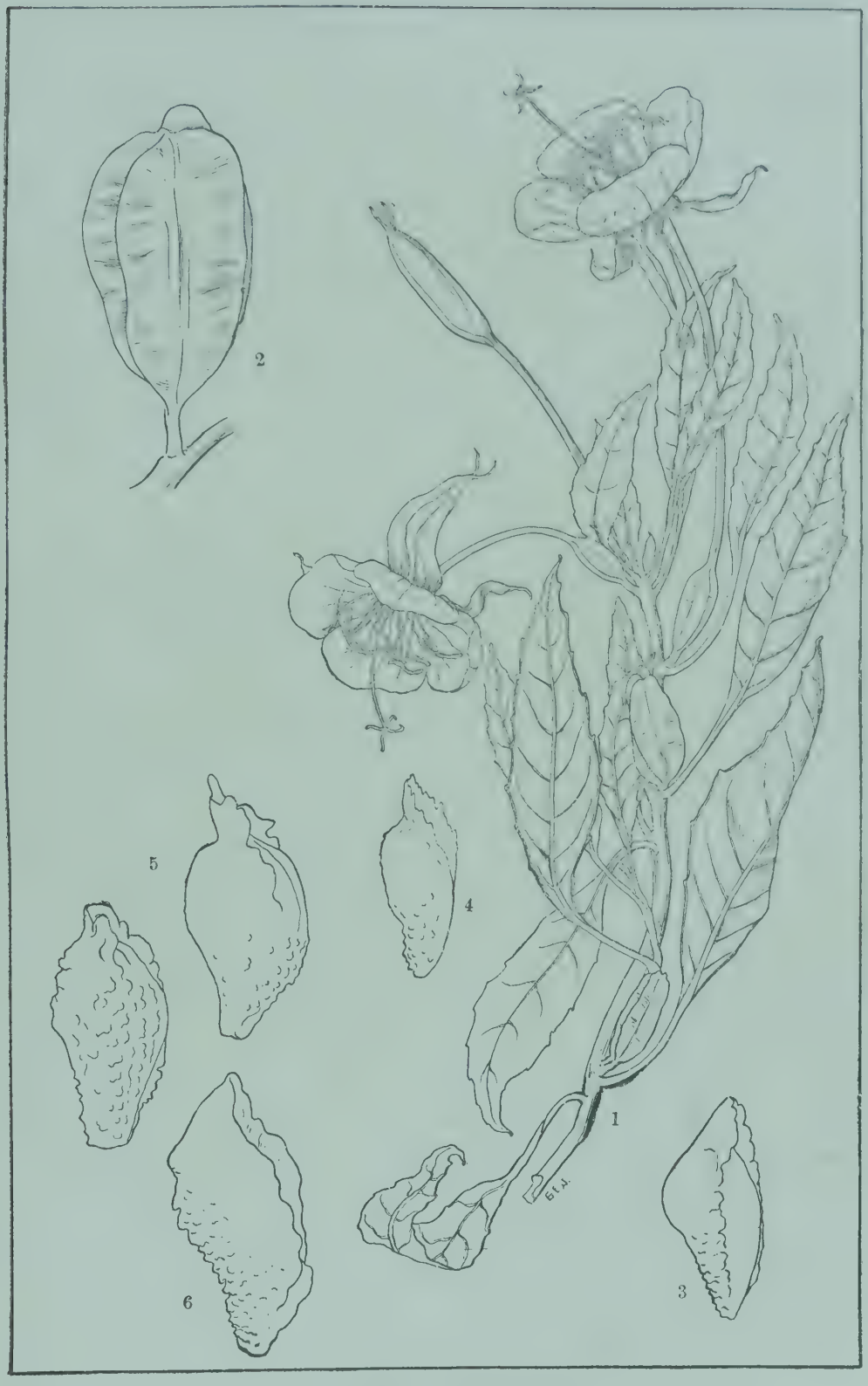
Plate 47. *Megapterium Oklahomense.*— 1, Plant, one-half size; 2, fruit, natural size; 3, seed, × 8. *Megapterium Fremontii.*— 4, Seed, × 8. *Megapterium Missouriense.*— 5, Seed of common form, × 8; 6, seed of Texan form, × 8.

Plate 48. *Lilaeopsis Carolinensis.*— 1, Portion of Joor plant, natural size; 2, portion of Langlois plant, natural size; 3, fruit, × 8; 4, flowering umbel, × 5.

Plate 49. *Euphorbia corollata Joorii.*— Plant, natural size; seed, × 8; involucre and capsule, × 5.

Plate 50. *Sagittaria arifolia aquatilis.*— Plant, one-half size; stamens and immature achenes, × 8.

KALLSTROEMIA PARVIFLORA.



MEGAPTERIUM.

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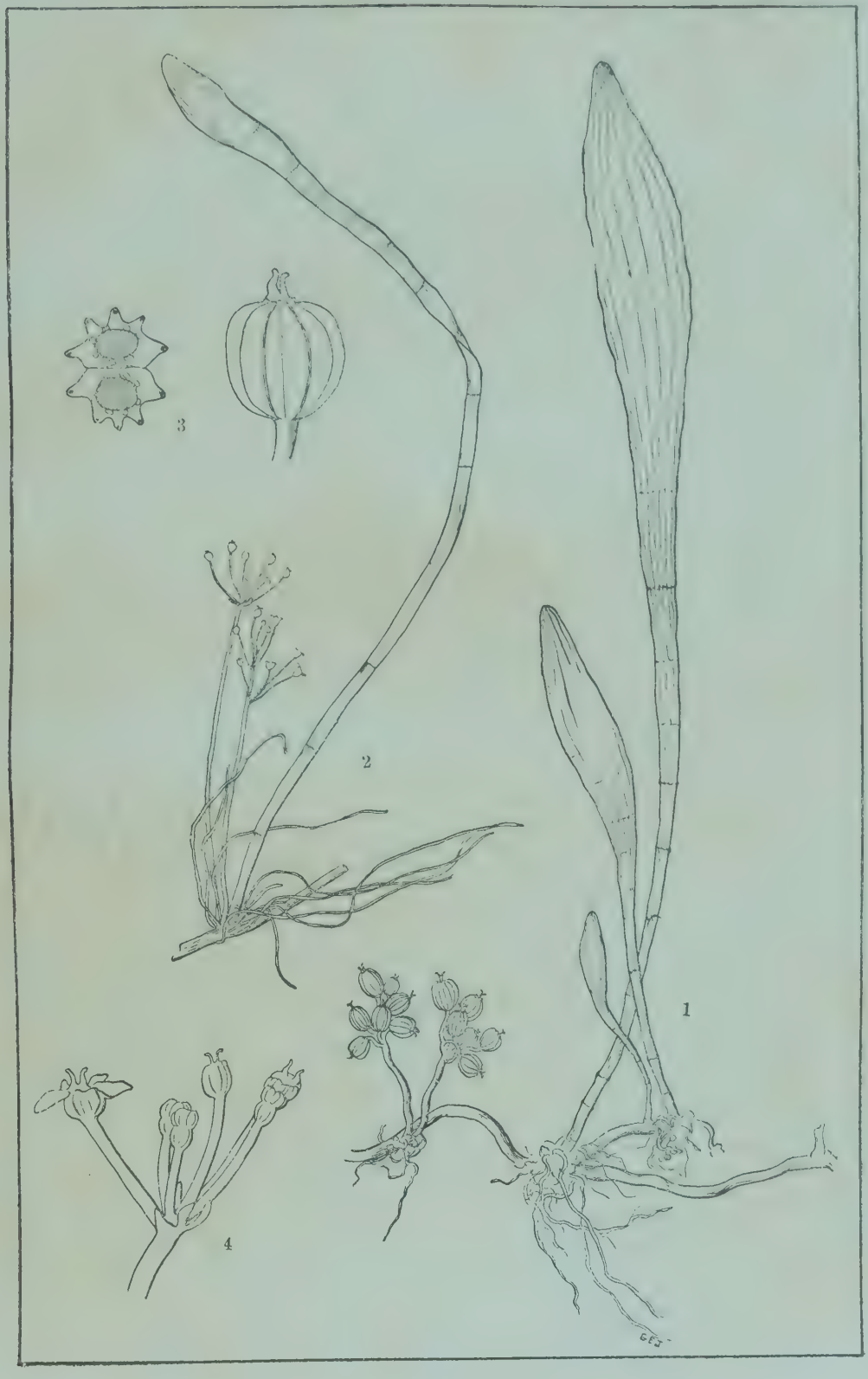


LILAEOPSIS.

EUPHORBIA COROLLATA JOORII.

SAGITTARIA ARIFOLIA AQUATILIS.

6. A NEW DISEASE OF CULTIVATED PALMS.

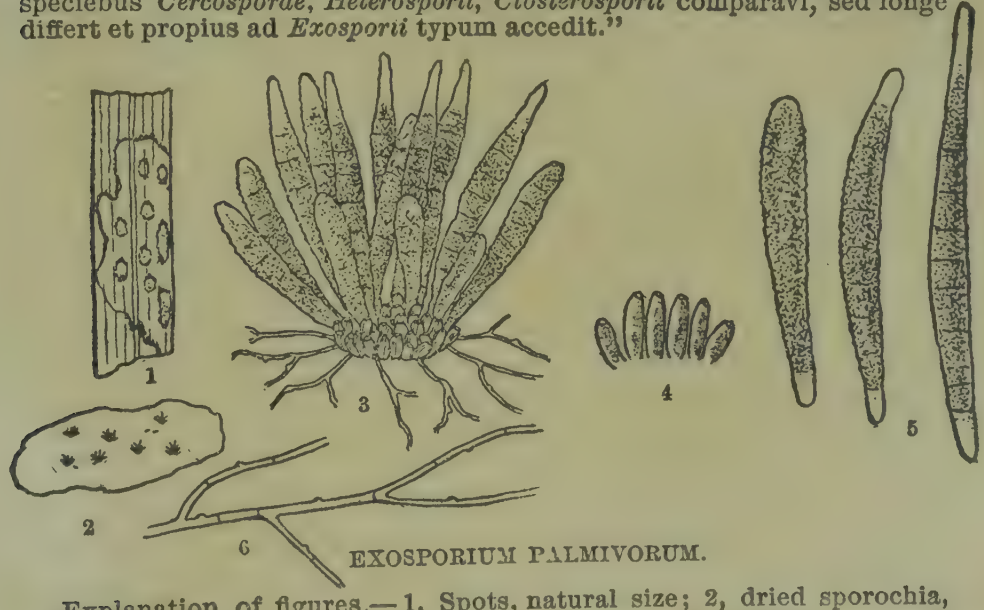
BY WILLIAM TRELEASE.

In October, 1897, Mr. W. J. Hesser, a large importer and grower of palms, sent to the Garden leaves of *Kentia* and *Phoenix* affected by unrecognized fungi. The latter were referred to Professor P. A. Saccardo, who reports that the one on young specimens of *Kentia* is *Gloeosporium Allescheri*, Bres., which, however, may be considered a palmicolous form of *G. sphaerelloides*, Sacc.

Concerning the fungus on *Phoenix* (*P. canariensis*, *P. tenuis* and *P. reclinata*, but chiefly the first named), Professor Saccardo says: "This is very interesting, and new, and I add a description of it:—

EXOSPORIUM PALMIVORUM. Sacc. n. sp. — Maculis amphigenis minutis suborbicularibus, 1–3 mm. diam., brunneis, interdum in area lata expellente foliorum sparsis; sporodochiis superficialibus in areolis brunneis dense gregariis, punctiformibus, nigris; basidiis oblongis, continuis, olivaceo rufis, 14–16×5–6 μ, in pulvinulum convexum 60–80 μ lat., 30 μ altum dense constipatis, monosporis; conidiis e basidio radiantibus fusoideis, rectis v. curvis, 80–90×8–9 μ, sursum obtuse tenuato-acutatis, basi obtusis, 8–10-septatis, non constrictis, olivaceo-fuscis, utrinque pallidioribus, conspicue, maxime prima aetate, verruculosis.— Hab. in foliis, qua valde vexantur et demum moriantur, palmarum (*Phoenicis* etc.), in calidariis, Plattsmouth, Nebr., Sept., 1897, comm. Prof. W. Trelease.

Mycelium circumcirca et infra sporodochia serpit et constat ex hyphis filiformibus, ramosis, septatis, olivaceis, 3 μ, cr., hinc inde denticulatis. Conidia juvenilia sunt breviora, sursum obtuse clavata nec acutata, 60–65×9 μ, magis aspera septisque minus manifestis.— Cum speciebus *Cercosporae*, *Heterosporii*, *Closterosporii* comparavi, sed longe differt et propius ad *Exosporii* typum accedit."



EXOSPORIUM PALMIVORUM.

Explanation of figures.— 1, Spots, natural size; 2, dried sporochia, enlarged; 3, sporochium; 4, basidia; 5, spores of various ages; 6, mycelium,— all greatly enlarged.

7. PARMELIA MOLLIUSCULA.

BY HENRY WILLEY.

In the report issued May 28, 1892,* Mr. T. A. Williams described and figured a fruiting specimen of *Parmelia molliuscula* from the Black Hills region. I have in my possession a specimen, or rather a fragment of one, collected by Mr. Brandegee on Soda Springs Lodge, Colorado, alt. 5,500 feet, in 1877, which is fertile, and which, so far as it goes, resembles the figure given by Mr. Williams. It presents a number of apothecia, crowded together, with a brown and at length blackening disk, and an incurved, more or less crenate margin. The spores are ellipsoid, measuring .011–.013 mm. long by .005–.006 mm. broad, thus agreeing well with the imperfect spores seen by Mr. Williams. The spermatia are staff-shaped, .007–.009 mm. long.

Dr. Nylander, to whom I sent a bit, suggested that it might be *P. subconspersa*, Nyl.; but the reaction with potash,— medulla blood red,— agrees with that given for *P. molliuscula*, and not with that of *P. subconspersa*, and I know of no better place for my fragment than with the former. It would be interesting to obtain further fertile specimens of this lichen, which was unknown in fruit before Mr. Williams' observation.

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* Rept. Mo. Bot. Gard. **3**: 169. *pl. 57.*